MOBILE RADIO

MASTR
PROGRESS LINE
Executive Series

MAINTENANCE MANUAL

Wall Mount Stations

Desk Top Stations

132—174 MHz

TWO-WAY FM STATION COMBINATION

LBI-4331B

Microphone

GENERAL ELECTRIC

MP MASTER
MA32629

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER	
	DESK TOP	WALL MOUNT
Transmitter	ET-74-A, B	ET-74-A, B
Receiver	ER-48-C	ER-48-C
Power Supply	4EP51A10	4EP51A10
Control Unit	4EC69A10-12	4EC70A10
Channel Guard Board	4EK14B10	4EK14B10
Four Freq. Oscillator Board	4EG22F10, 11	4EG22F10, 11
Remote Control Board	4KC18A14, 15	4KC18A14-17
Power Cable	19A122527G2	19A122527G1
Microphone	4EM28A10, B10	
Top Cover	19A122161G1	
Bottom Cover	19B205299G1	
Weatherproof Cabinet		19D402658G1
Option Cover Plate Kit	19A122213G1	19A122213G1
Alignment Tools Hex Slug Type Slotted Screw Type	 4038831P2 4033530G2	 4038831P2 4033530G2
Lock Assembly Key Lock		 5491682P8 5491682P14

OPTIONAL EQUIPMENT

OPTION	EQUIPMENT	OPTION	EQUIPMENT
8401	12-Hour Clock (117 VAC, 60 Hz)	8424	Cabinet Heater (117 VAC, 50/60 Hz)
8402	12/24-Hour Clock (117 VAC, 60 Hz)	8461	12-Hour Clock (220 VAC, 60 Hz) and Test Meter.
8403	Test Meter	8462	12/24-Hour Clock (220 VAC, 60 Hz) and Test Meter.
8404	12-Hour Clock (117 VAC, 60 Hz) and Test Meter.	8463	12-Hour Clock (220 VAC, 50 Hz) and Test Meter.
8405	12/24-Hour Clock (117 VAC, 60 Hz) and Test Meter.	8464	12/24-Hour Clock (220 VAC, 50 Hz) and Test Meter.
8412	12-Hour Clock (220 VAC, 60 Hz)	8465	12-Hour Clock (117 VAC, 50 Hz) and Test Meter.
8413	12/24-Hour Clock (220 VAC, 60 Hz)	8466	12/24-Hour Clock (117 VAC, 50 Hz) and Test Meter.
8414	12-Hour Clock (220 VAC, 50 Hz)	8467	Fan (220 VAC, 60 Hz)
8415	12/24-Hour Clock (220 VAC, 50 Hz)	8468	Fan and Cabinet Heater (220 VAC, 60 Hz)
8416	12-Hour Clock (117 VAC, 50 Hz)	8493	Handset (4EM26A10) & Hookswitch
8417	12/24-Hour Clock (117 VAC, 50 Hz)	8494	Handset (4EM26A10)
8418	Cabinet Heater (220 VAC, 50/60 Hz)	8495	Military Microphone (19B209102P2)
8421	Speaker (4EZ16A18) & Microphone (19B209102P2)	8308	Carrier Control Timer (19A127875G5)
8422 & 8423	Fan (117 VAC, 60 Hz)		

SPECIFICATIONS *

GENERAL

FREQUENCY RANGE	132-174 MHz
DIMENSIONS (H x W x D)	
Desk Top	5-3/4" x 20" x 13-3/4"
Wall Mount	21-1/4" x 22-1/2" x 6-7/8"
WEIGHT	
Desk Top	43-1/2 pounds
Wall Mount	68-1/4 pounds
INPUT VOLTAGE	117/220 VAC ±20%, 50/60 Hz
INPUT POWER	
Standby (transmitter filaments on)	28 Watts
Transmit	150 Watts
OPERABLE TEMPERATURE RANGE	-30°C to +60°C (-22°F to 140°F)
DUTY CYCLE	Transmit: 20% Receive: 100%
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

TYPE NUMBER	ET-74-A (Narrow Band) ET-74-B (Wide Band)
POWER OUTPUT	35 Watts (132-162 MHz) 30 Watts (162-174 MHz)
FREQUENCY STABILITY	±.0005% (-30°C to +60°C, +25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 60 dB below rated power output
MODULATION	Adjustable from 0 to ±5 kHz (Narrow Band) and 0 to ±15 kHz (Wide Band) swing with instantaneous modulation limiting.
AUDIO FREQUENCY CHARACTERISTICS	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards.
DISTORTION	Less than 5%
DEVIATION SYMMETRY	0.6 kHz maximum (Narrow Band) 2.0 kHz maximum (Wide Band)
CRYSTAL MULTIPLICATION FACTOR	24

RECEIVER

TYPE NUMBER	ER-48-C
AUDIO OUTPUT	2 Watts at less than 5% distortion 3 Watts at less than 15% distortion
SENSITIVITY	
12-dB SINAD (EIA Method)	0.25 µV
20-dB Quieting Method	0.35 µV
SELECTIVITY	
EIA Two-Signal Method	-85 dB - adjacent channel 30 kHz channels
20-dB Quieting Method	-100 dB at ±20 kHz
SPURIOUS RESPONSE	-90 dB
FIRST OSCILLATOR STABILITY	±.001% (-30°C to +60°C), +25°C reference
MODULATION ACCEPTANCE	±7 kHz
INTERMODULATION	-70 dB
FREQUENCY RESPONSE	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz
SQUELCH SENSITIVITY	
Critical Squelch	4 dB SINAD (0.1 µV typical)
Maximum Squelch	Greater than 20 dB quieting

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

DESCRIPTION

MASTR Progress Line Desk Top and Wall Mount stations are attractively styled base stations that are designed to meet the most stringent requirements in the field of Two-Way radio. The transmitter exciter board and the receiver are fully transistorized, utilizing silicon transistors for added reliability.

The stations are designed for ease of maintenance. All major modules and tuning adjustments are easily accessible. The Desk Top station transmitter receiver assembly tilts up to provide access to both sides of the unit. In Wall Mount stations, the entire chassis swings out and the transmitter-receiver assembly tilts down to provide access to both sides of the unit.

The transmitter and receiver are equipped with centralized metering jacks for simplified alignment and troubleshooting. The Desk Top station may also be equipped with a built-in test meter to facilitate servicing. The module layout for the stations is shown in Figure 1.

The transmitter and receiver may be used interchangeably with transmitter and receiver modules in MASTR Executive Series mobile combinations. No modifications are required when transferring the units from one type of operation to another.

TRANSMITTER

The transmitter assembly consists of the transistorized exciter board and the power amplifier section. The transmitter uses only three tubes in the power amplifier. The standard transmitter may be equipped with:

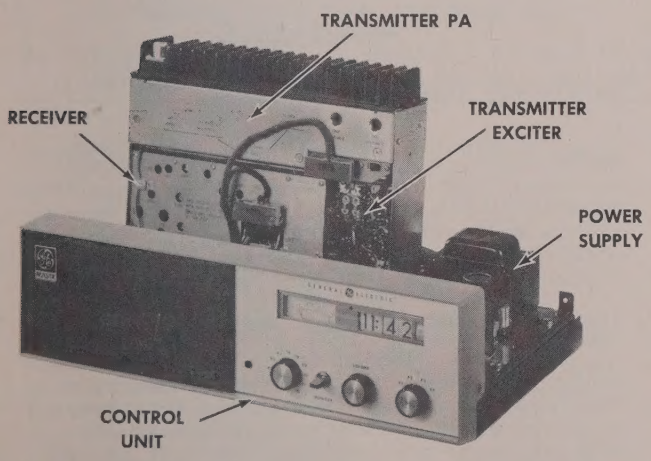
- One through four frequencies
- Channel Guard

RECEIVER

The fully transistorized receiver is mounted on a single printed wiring board for increased reliability. A copper-plated housing and metal cover that completely encloses the receiver provides excellent shielding. The standard receiver may be equipped with:

- One through four frequencies
- Channel Guard

DESK TOP



WALL MOUNT

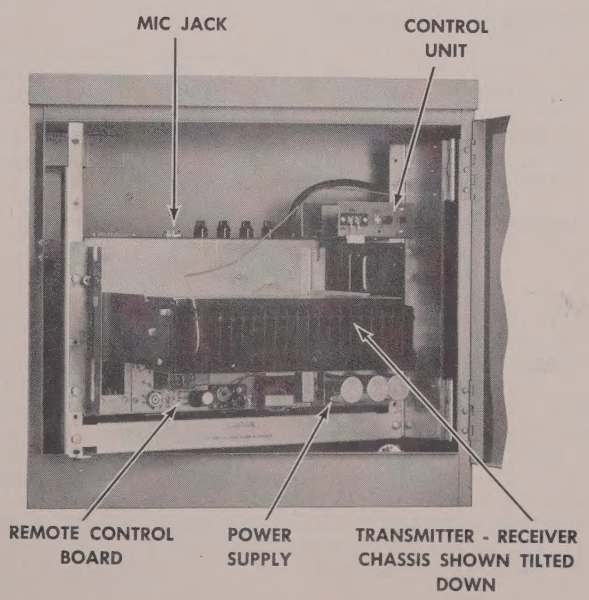


Figure 1 - Module Layout

POWER SUPPLY

The power supply provides operating voltage for the transmitter and receiver. In addition to plate, screen and bias voltages for the transmitter PA, the power supply provides a regulated +10 Volts for the transmitter exciter board, receiver and four-frequency oscillator board.

CONTROL UNITS

Two different control units are used with the stations. The Desk Top control unit is mounted on the front of the station so that the control will be within convenient reach of the operator. The Wall Mount control unit is mounted within the weatherproof cabinet on the top of the chassis.

INITIAL ADJUSTMENT

After the station combination has been installed (as described in the INSTALLATION Manual), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radiotelephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form ECP-82) has been filled out and attached to the transmitter.

TRANSMITTER ADJUSTMENT

The initial adjustment for the transmitter includes loading the power amplifier into the antenna, and checking the frequency and modulation. For the Initial Adjustment procedure, refer to the transmitter ALIGNMENT PROCEDURE.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes adjusting the receiver to the system operation frequency, and matching the antenna transformer to the antenna. For the initial adjustment procedure, refer to the FRONT END ALIGNMENT PROCEDURE.

REMOTE CONTROL BOARD

In local/remote and remote control applications, it is necessary to set the Mic Level Adjust control (R1) on the remote control board. Refer to the ADJUSTMENT PROCEDURE on Page 14.

OPERATION

The basic procedures for receiving and transmitting messages on the Desk Top station are as follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right. This lights the green power-on lamp.

2. Press down the MONITOR switch and adjust the VOLUME control for a comfortable listening level. Release the MONITOR switch.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the OFF-VOLUME control to the ON position. Let the unit warm up for 30 seconds.

2. Press the push-to-talk button on the microphone and speak in a normal (or softer) voice six inches away from the front of the mike. Release the button as soon as the message has been given. The red signal light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

NOTE

For Desk Top Stations equipped with Channel Guard desk-type microphone Model 4EM28B10, press the MONITOR button down before sending a message and listen to make sure that no one is using the channel. To send a message, press down the TRANSMIT button while holding the MONITOR button down. The MONITOR button may be released after the TRANSMIT button is depressed.

MAINTENANCE

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts. This preventive maintenance should include the maintenance checks listed on following page.

TEST AND TROUBLESHOOTING PROCEDURES

Whenever difficult servicing problems occur, the test procedure for transmitter and receiver can be used by the serviceman to compare the actual performance of the unit against the specifications met by the unit when shipped from the factory. The test procedures are located on the back of the applicable Alignment Procedure.

In addition, specific troubleshooting procedures are available for the transmitter, receiver and power supply (refer to the Table of Contents). For best results, the test procedures should be used in conjunction with the troubleshooting procedures.

PREVENTIVE MAINTENANCE PROGRAM

CHECK THE FOLLOWING ONCE A YEAR:	
1. Transmitter frequency and deviation (FCC requires this check-up at least ONCE a year).	☐
2. Measure and record the antenna system V.S.W.R.	☐
3. For 117 VAC operation, check input voltage at TB501-18 and -22 on power supply. Reading should be within 10% of 117 VAC. (Also check during routine service calls).	☐
4. Compare and record transmitter meter readings with voltages taken during initial tune-up. Retune, if necessary.	☐
5. Compare and record receiver meter readings with voltages taken during initial tune-up. Retune, if necessary.	☐
6. Check for positive indication of pressure on transmission line pressure gauge (if pressurized line is used).	☐
7. Clean dust from fan blades and lubricate bearings.	☐
8. Burnish pitted or coated relay contacts to smooth out metallic deposits or remove the coating.	☐

MAKE THE FOLLOWING MAINTENANCE CHECKS DURING ROUTINE CALLS:	
1. Check antenna lines and mast for mechanical stability.	☐
2. Visually check:	
External cables	☐
Internal cables	☐
Plugs	☐
Sockets	☐
Terminal boards	☐
3. Check for tightness of nuts, bolts, and screws to make sure nothing is working loose from its mounting.	☐
4. Replace tubes as necessary. (It may be convenient to replace all station tubes during the yearly check-up).	☐

INTERMODULATION IMPROVEMENT KIT OPTION 8302

This modification kit is used to decrease the receiver sensitivity. The installation of this kit consists of lifting one lead of C305 in the first RF amplifier input circuit and adding a 39 ohm resistor in series with C305. The 20 dB quieting sensitivity is changed to 0.6 m Volt and 12 dB Sinad is changed to 0.4 m Volt. The Intermodulation specification remains the same. Increasing the value of the added resistor improves the intermodulation specification but also further decreases the sensitivity of the receiver.

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Types ET-74-A and ET-74-B are crystal controlled, frequency modulated transmitters designed for one-, two- or four-frequency operation in the 132-174 megahertz band in mobile or station applications. The transmitter consists of the following modules:

- Transistorized Exciter Board - Audio, oscillator, modulator and multiplier stages.

PA ASSEMBLY	EXCITER BOARD	NO OF FREQUENCIES
4EF32F10 (132-150.8 MHz) 4EF32F11 (150.8-174 MHz)	4EG21F10 (Narrow Band) 4EG21F12 (Wide Band)	One-Frequency
4EF32F10 (132-150.8 MHz) 4EF32F11 (150.8-174 MHz)	4EG21F11 (Narrow Band) 4EG21F13 (Wide Band)	Two-Frequency

- PA Assembly - Multiplier, driver, power amplifier, low-pass filter and antenna relay.

The model number and number of frequencies of each module is shown in the above chart.

The transmitter uses a total of 7 transistors and 3 tubes to provide a minimum power output of 35 Watts in the 132-162 MHz range, and 30 Watts in the 162-174 MHz range. The crystals used range from approximately 5.5 to 7.3 megahertz, and the crystal frequency is multiplied 24 times.

A centralized metering jack (J201) is provided for use with GE Test Set Model 4EX3A10. The test set meters the phase modulator, multipliers, driver and PA stages, as well as the B-plus and regulated supply voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

POWER INPUTS

All supply voltages are connected from the power supply to the transmitter through two 7-pin miniature connectors (J202 and J203). Voltages for the PA assembly are connected through J202, and are filtered by feed-through capacitors C222 through C229. Supply voltage, metering and control functions for the exciter board are connected from the PA assembly through a 9-pin miniature connector (J105). Supply voltages for the transmitter are shown in the following chart.

Connection	Voltage	Use
J202-1	+450 VDC	PA B-plus
J202-2	+300 VDC	multiplier B-plus
J202-3	ground	
J202-4	-55 VDC	PA bias
J202-5	+12 VDC	relay supply
J202-6 & -7		filament
J105-2	+10 VDC reg.	Exciter supply

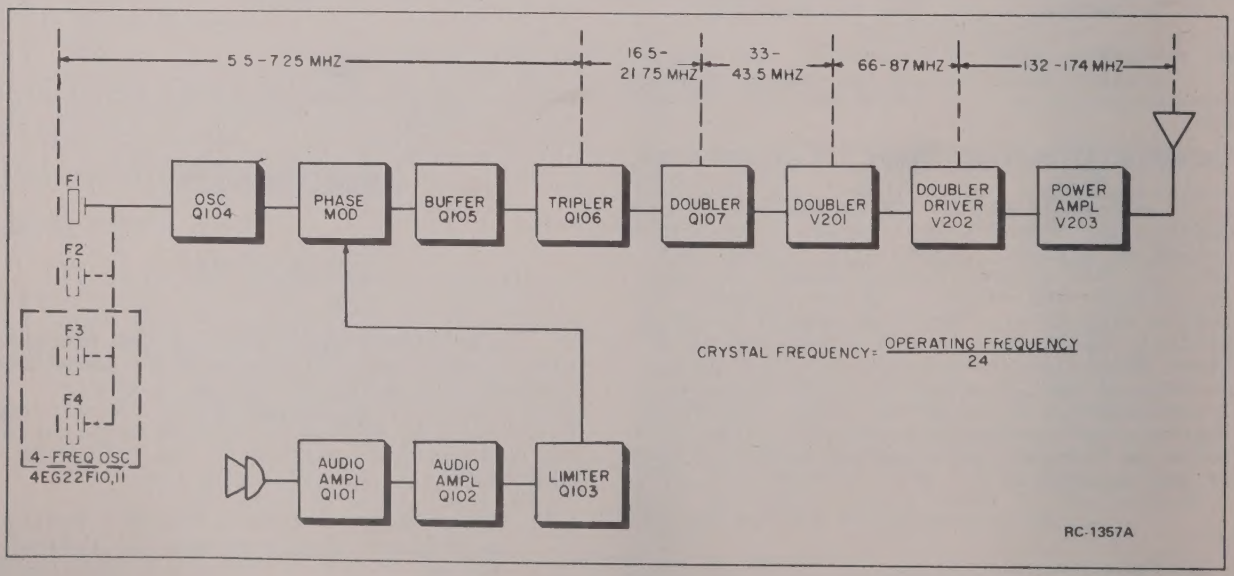


Figure 2 - Transmitter Block Diagram

EXCITER BOARD

OSCILLATOR

A transistorized Colpitts oscillator (Q104) is used in the transmitter. The oscillator crystal is thermistor-compensated at both ends of the temperature range to provide instant frequency compensation with a frequency stability of ±.0005% without crystal ovens or warmers. Feedback for the oscillator is developed across C113.

In single-frequency transmitters, a jumper connects the F1 crystal keying lead to ground and the crystal frequency is applied to the base of oscillator Q114.. The oscillator output is applied to the anode of phase modulator CV101.

In two-frequency transmitters, the single oscillator transistor is used, and an additional crystal circuit and two diodes (CR101 and CR102) are added. The keying jumper is removed, and the proper crystal frequency is selected by switching the crystal keying lead to ground by means of a frequency selector switch on the Control Unit. This forward biases the diode in the crystal circuit, reducing its impedance, so that the selected crystal frequency is applied to the base of oscillator Q104.

For four frequency transmitters, oscillator board Model 4EG22F10 or 11 is added. The oscillator board contains two crystal circuits (F3 and F4) identical to the F1 and F2 circuits. In four-frequency transmitters, F3 and F4 crystals are also switched by means of diode biasing. The output of the oscillator board is connected through J2603 to the base of Q104.

AUDIO AMPLIFIERS AND LIMITER

The audio section of the transmitter consists of DC-coupled feedback amplifiers Q101, Q102 and Q103. Q103 also acts as a limiter at high audio input levels. Audio from the microphone is coupled through an input network (C132 and R164) to the audio stages. The input network, in conjunction with the feedback circuit, provides the audio gain and a 6-dB/octave pre-emphasis.

The output of limiter Q103 is connected through modulation adjust potentiometer R110 to a de-emphasis network for a 6-dB/octave de-emphasis and post limiter roll-off. The network consists of C136, C136, C138, R165 and R166. Modulation Adjust R110 determines the maximum signal level applied to the modulator circuit, and is normally set for ±4.5 kHz (narrow band) or ±13.5 kHz (Wide Band).

PHASE MODULATOR

The phase modulator uses varactor CV101 (a voltage-variable capacitor) in an R-L-C network that includes R126 and L113. An audio signal resulting in a phase modulated output. The modulator output is fed to the base of buffer Q105.

In Channel Guard applications, tone from Channel Guard board Model 4EK14A10 is fed to the modulator circuit through J103 (tone high) and J104 (ground).

BUFFER AND MULTIPLIERS

Buffer stage Q105 isolates the modulator from the loading effects of the tripler stage, and provides some amplification. The output is DC coupled to the tripler.

Following Q105 are two L-C coupled Class C multiplier stages (Q106 and Q107). Q106 is a tripler stage with the collector tank tuned to three times the crystal frequency. The stage is metered at J201 through metering resistors R130 and R131.

Q107 operates as a doubler stage, with the collector tank tuned to six times the crystal frequency. Resistors R134 and R135 are for metering the doubler stage at centralized metering jack J201.

PA ASSEMBLY

MULTIPLIERS

The output of the transistorized exciter is link-coupled through T201, to the grid of beam pentode V201. This stage operates as a doubler with T202 tuned to 12 times the crystal frequency. The grid of V201 is metered through R201 and R202 at J201.

The output of V201 is transformer-coupled to the grid of beam pentode V202. This stage operates as a doubler-driver with the output tuned to 24 times the crystal frequency. The grid of V202 is metered through metering network R207 and R208.

POWER AMPLIFIER

The output of V202 is coupled to the grid of compactron beam power amplifier (V203) by a pi-network consisting of C209, L205 and C236/C210. The grid is tuned by C209 (PA GRID), and current is metered at J201-6 and J201-14 by measuring the voltage drop across R210. Bias voltage (-55 Volts) is applied to the PA grid through R201, L209 and L205.

Plate current is metered from J201-1 to J201-9 across metering resistor R214. Plate voltage is supplied through L206, and the PA plate tank is series-tuned by capacitor C214. The screen grid dropping resistor is R213.

WARNING

The meter leads are at plate potential (high B+) when metering the PA plate at J201-1 and J201-9.

Placing TUNE-OPERATE switch S201 in the OPERATE position effectively shorts R212 out of the circuit, and applies 300 Volts to grid dropping resistor R213 for normal operation of the stage. Placing the switch in the TUNE position applies the screen voltage to dropping resistor R212 and shunt resistor R211 to drop the screen voltage. This reduces the plate dissipation while tuning the transmitter.

PA loading is achieved by varying the coupling between L207 and L208. The antenna circuit is tuned by C215.

RF from the antenna coil is fed through antenna changeover relay K201 to the low-pass filter, and then to the antenna

RECEIVER

Receiver Type ER-48-C is a double conversion, superheterodyne FM narrow-band receiver designed for one-, two-, or four-frequency operation on the 132-174 megahertz band in mobile or station applications.

The receiver is of single-unit construction and is housed in a copper-plated casting for maximum shielding and rigidity. The unit is completely transistorized, using a total of 20 silicon transistors. Frequency ranges and the number of frequencies for each receiver model are shown in the following chart.

Receiver Model	Frequency Range	No of Frequencies
4ER48C10	132-150.8 MHz	One-Freq.
4ER48C11	132-150.8 MHz	Two-Freq.
4ER48C12	150.8-174 MHz	One-Freq.
4ER48C13	150.8-174 MHz	Two-Freq.
4ER48C14	132-150.8 MHz	Four-Freq.
4ER48C15	150.8-174 MHz	Four-Freq.

A regulated +10 Volts is used for all receiver stages except the audio driver and audio PA stages, which operate from the 12-Volt system supply. The audio PA stage and output transformer are mounted on the underside of the system frame behind the power supply.

Centralized metering jack J304 is provided for use with GE Test Set Model 4EX3A10. The test set meters the oscillator, 1st and 2nd limiters, discriminator and audio PA as well as the voice coil, regulated 10 Volts and 12-Volt supply.

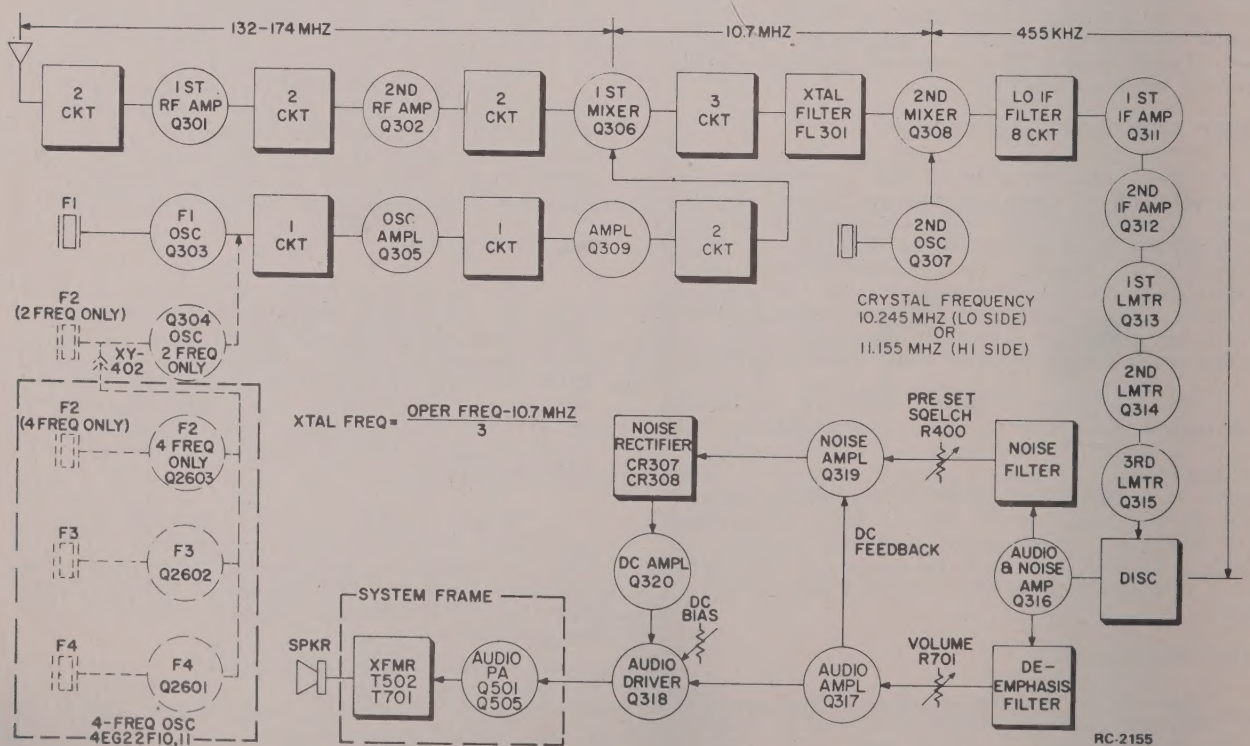


Figure 3 - Receiver Block Diagram

RF AMPLIFIERS

RF signals from the antenna are fed to the base of 1st RF amplifier Q301 through two tuned pre-selector circuits. The output signal is inductively coupled through two tuned circuits to the gate of 2nd RF amplifier Q302.

The Second RF Amplifier uses a Field-Effect Transistor (FET) as the active device. The FET may be considered a semiconductor current path (or channel) whose resistance is varied by a voltage applied to the control element (gate). Lead identification for the FET is shown in Figure 4A.

The FET has several advantages over a conventional transistor, including a high input impedance, high power gain, and an output that is relatively free of harmonics (low in intermodulation products). The FET also has voltage-controlled characteristics, and may be compared to a vacuum tube in operation (see Figure 4B).

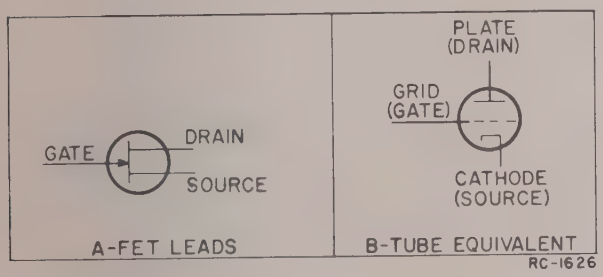


Figure 4 - FET Nomenclature

Q302 operates as a grounded-gate amplifier. This method of operation provides a low impedance input to the amplifier. The amplified output is taken from the drain terminal and coupled through a tuned circuit (L305, C315 and C316) to the input of the first mixer.

OSCILLATOR

Q303 is a third mode oscillator that operates in the 40 to 55 megahertz region. The crystal is connected in the oscillator feedback path to permit oscillation only at the crystal frequency. L307, C319 and C320 make up the mode selective resonant circuit. Adjustable coil L307 permits the oscillator frequency to be shifted slightly for setting the receiver on the system operating frequency. The collector tank of Q303 is tuned to three times the crystal frequency.

For two-frequency operation, a second oscillator stage is added. Channels are selected by grounding the emitter of the desired oscillator by means of a two-frequency switch on the control unit.

For four-frequency operation, four-frequency oscillator board contains three oscillator circuits (F2, F3 and F4) that are similar to the F1 oscillator circuit. The output lead of the oscillator board is plugged into crystal socket XY402, and the F2 oscillator board is modified so that Q304 can be used as an amplifier stage. Channels are selected by grounding the emitter of the desired oscillator by means of a four-frequency switch on the Control Unit.

1st MIXER AND CRYSTAL FILTER

The RF signal from the 2nd RF amplifier and the low-side injection voltage from oscillator-amplifier Q309 are applied to 1st Mixer Q306.

The 1st Mixer uses a Field-Effect Transistor (FET) as the active device (Figure 4).

RF is applied to the gate of Q306, and injection voltage from the oscillator amplifier is applied to the source. The mixer output is taken from the drain with the output tuned to the 10.7 MHz high IF frequency.

The 10.7 megahertz High IF output is coupled through three tuned circuits (L312 and C350, L313 and C354, L314 and C357) which provide High IF selectivity and impedance matching to the crystal filter.

The Hi-IF crystal filter (FL301) has ample selectivity to prevent adjacent channel signals from overloading the 2nd Mixer, and to reduce intermodulation spurious responses.

2ND OSCILLATOR AND MIXER

Hi-IF from the crystal filter is applied to the base of 2nd Mixer Q308 with the 10.245-MHz (or 11.155 MHz) 2nd Oscillator output to produce the 455-kHz Lo-IF.

The 455-kHz Lo-IF is coupled to an eight-coil Lo-IF filter which provides the main receiver selectivity.

LO-IF AMPLIFIERS AND LIMITERS

Following the Lo-IF filter are two R-C coupled Lo-IF amplifiers (Q311 and Q312). The amplified output is fed to three R-C coupled limiter stages consisting of Q313, Q314 and Q315, operating as overdriver amplifiers. The 1st and 2nd limiter stages are metered at centralized metering jack J304 thru metering diodes CR302 and CR303.

DISCRIMINATOR

The 3rd limiter output is applied to the Foster-Seely type discriminator, where the audio voltages are recovered from the 455-kHz Lo-IF. A low-pass filter, made up of C422, C423, C424, R377, R379 and R380, removes any 455-kHz signal from the discriminator output.

AUDIO AMPLIFIER AND DRIVER

The audio signal is fed to the base of audio-noise amplifier Q316. Following Q316 is an audio de-emphasis network consisting of C426, C427, C428, R383, R384 and R385.

After the de-emphasis network, the audio signal is fed to the base of audio amplifier Q317 through the VOLUME control mounted on the control unit. The VOLUME control is used to set the amount of drive to audio amplifier Q317, audio driver Q318, and audio PA Q505. DC BIAS trimmer R392 sets the bias on Q318 and Q505, and is adjusted for a 280 millivolt (500 milliamps) reading at metering jack J304-9. The output of Q505 drives the loudspeaker.

SQUELCH

Noise from audio-noise amplifier Q316 is used to operate the squelch circuit. When no carrier is present in the receiver, this noise is coupled through a noise filter (which attenuates any audio frequencies) to the base of noise amplifier Q319. The noise filter consists of C435, C436, C437, and L331. The noise level fed to the noise amplifier is set by SQUELCH control R400. The output of noise amplifier Q319 is rectified by diodes CR307 and CR308, and filtered by C441 and C461 to produce a positive DC voltage. This DC voltage turns on DC amplifier Q320, causing it to conduct. When conducting, the collector voltage of the DC amplifier drops to near ground potential, which lowers the bias on audio stages Q317 and Q318, turning them off.

As audio amplifier Q317 is being turned off, its emitter potential decreases. This results in a positive DC feedback through R406 to the emitter of noise amplifier Q319 which causes an increase in the gain. As the gain of Q319 increases, the positive DC voltage to the DC amplifier increases, quickly turning the audio stages off.

When the receiver is quieted by a signal, less noise is present in the circuit and the DC amplifier turns off. The audio stages are allowed to conduct, and audio is heard from the speaker. When audio amplifier Q317 is conducting, a positive voltage appears across R406 which helps reduce the gain of noise amplifier Q319. This positive feedback causes a quick, positive switching action in the squelch circuit.

POWER SUPPLY

Power Supply Model 4EP51A10 is used to supply all voltages for the Desk Top or Wall Mount station combinations. The power supply provides:

- Plate, screen and bias voltages for the transmitter multiplier and power amplifier stages,
- Regulated +10 Volts for the transmitter exciter board,
- Regulated +10 Volts for the receiver and four-frequency board,
- +12 Volts for the relays and receiver audio amplifiers,
- AC filament voltage.

The power transformer (T501 and T502) connected in parallel are used in the power supply. Power is applied to the transformer primaries by turning power switch S502 (on back of the station chassis) to the ON position. A 3-amp fuse (F501) in one side of the AC lead protects the power supply against overloads.

The power supply is designed for operation from either a 117 VAC or 220 VAC, 50/60 Hz source. The station is normally shipped connected for 117 VAC operation, with the primary windings of T501 and T502 connected in parallel. For 220 VAC operation, the transformer primaries are connected in series. Refer to the power supply Schematic Diagram for 220 VAC transformer connections.

RECTIFIER AND FILTER CIRCUITS

Negative Bias Supply

The AC voltage developed across secondary windings 8-10 of transformer T501 is rectified by full-wave rectifiers CR501 and CR502. The rectified voltage is then filtered by C501 and R401 to supply a negative 55 Volts for the control grid of the transmitter power amplifier. The bias voltage is present as a protective measure to limit cathode current in the PA tube while the PA is untuned, or in the case of loss of drive to the PA.

Multiplier B-Plus (Figure 5)

The AC voltage developed across high voltage secondary windings of T501 is rectified by a full-wave bridge rectifier circuit.

During one-half of each AC cycle, the voltage across T501-6 and -7 of the high voltage output winding is rectified by CR507 and CR509. During the second half of the

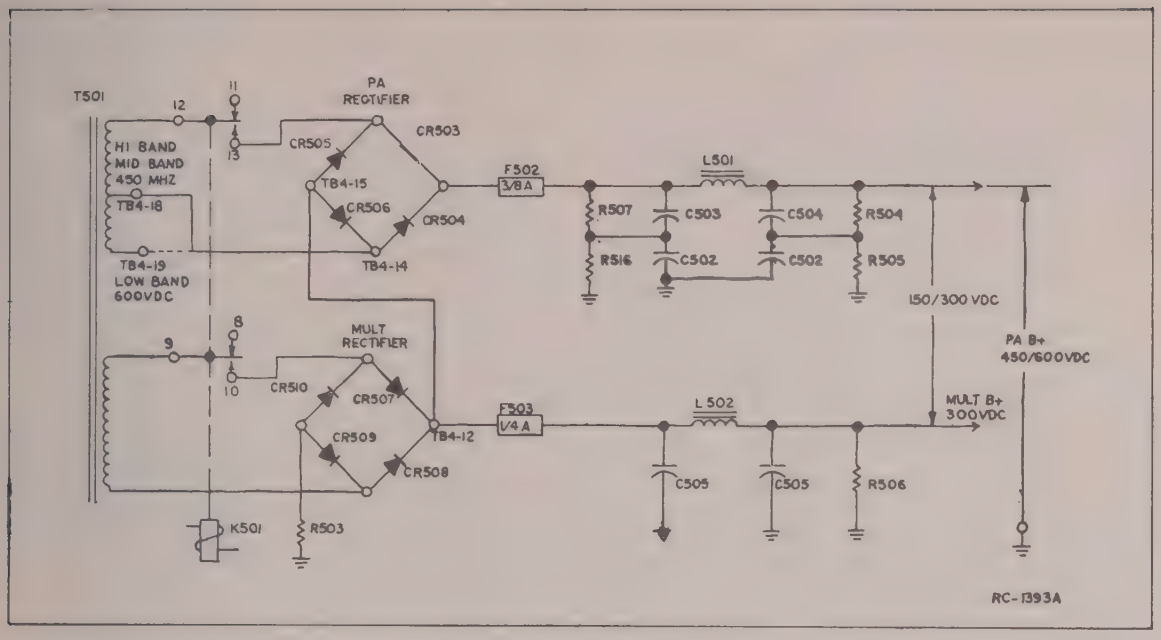


Figure 5 - Multiplier and PA B-Plus Circuits

cycle, the voltage is rectified by CR508 and CR510.

Filtering is provided by L-C filter C505 and L502. R506 is a bleeder resistor. The transformer and rectifiers are protected by fuse F503.

Power Amplifier B-Plus (Figure 5)

High B-Plus for the power amplifier is provided by the PA rectifier circuit and the multiplier rectifier circuit connected in series.

In high band stations, a jumper is connected from TB4-14 to TB4-18, and the AC Voltage developed across T501-11 and -12 is rectified by CR503 and CR504. This output, in series with the multiplier output, supplies 450 Volts DC high B-plus.

In low band stations, the jumper is connected from TB4-14 to TB4-19, and the AC voltage is rectified by a bridge rectifier circuit consisting of CR503, CR504, CR505 and CR506. This output, in series with the multiplier output, supplies 600 Volts DC high B-plus.

The PA filter consists of C502, C503, L501 and C504. R504, R505, R507 and R510 are bleeder resistors. The rectified circuit and transformer are protected by fuse F502.

12-Volt Supply

The AC voltage developed across secondary windings 8-10 of transformer T502 is rectified by full-wave rectifiers CR511 and CR512. The output is filtered by C506 and L503 to provide a nominal 12 Volts for the push-to-talk and antenna switching relays, receiver audio amplifiers and 10-Volt regulator A501. The rectifiers and transformer are protected by fuse F504.

Filament Supply

The 12-Volt, AC filament supply and pilot light voltage is taken from the voltage developed across windings 6-7 of transformer T502.

+10 VOLT REGULATOR (A501)

The 10-Volt regulator provides a closely controlled supply voltage for the transmitter exciter, receiver and four-frequency oscillator board.

When the output voltage at the emitter of Q1 tries to increase, the voltage at the base of Q2 tends to become more positive. This makes Q2 conduct more heavily, causing the voltage at the base of Q1 to become more negative. With less base bias, Q1 conducts less and the voltage drop across the transistor is larger. This keeps the output voltage constant.

When the output voltage tries to decrease, Q2 conducts less and the base bias on Q1 increases. This causes Q1 to conduct more heavily, reducing the voltage drop

across the transistor and keeping the output constant.

Potentiometer R3 and resistor R4 form a voltage divider so that R3 can be adjusted for a +10 Volt output. Zener diode VR1 provides a voltage reference for the regulator. The output can be metered at the transmitter and receiver centralized metering jacks.

Microphone Pre-Amplifier (A502)

Microphone pre-amplifier A502 provides an additional 10-dB gain for use with desk-type microphones. When a military mike or handset is used, the pre-amplifier is disconnected from the circuit by moving lead P1 from J1 to J2 (refer to Power Supply Outline Diagram) so that the signal is connected directly to the transmitter.

The audio signal from the desk-type mike is connected to the pre-amp transistor Q1 through coupling capacitor C1. Following amplifier Q1, the signal is coupled through audio coupling capacitor C2 to the transmitter.

Base bias for Q1 is provided through voltage divider circuit R1 and R2 from the 10-Volt regulated supply.

CHANNEL GUARD MONITORING

In Desk Top stations, Channel Guard monitoring is provided by monitoring transistor Q701. The transistor and biasing resistor R701 are mounted on TB701 on the main chassis.

The base of Q701 is connected to ground through the normally-closed contacts of the MONITOR switch on Channel Guard microphone Model 4EM28B10. The collector is connected to J601-7 on Channel Guard board Model 4EK14B10.

Pressing the MONITOR switch removes the ground on the base of Q701, causing it to conduct. When conducting, the collector of Q701 drops to near ground potential, disabling the decoder circuitry so that the receiver operates on noise squelch only.

CONTROL UNITS

DESK TOP CONTROL UNIT

Three different models of control units are available for use with Desk Top station combinations. All models of the Control Unit have a VOLUME CONTROL, a MONITOR switch, a green Power-On light, a red Transmit light, an audio transformer and speaker. In addition, control units in multi-frequency combinations are equipped with a frequency selector switch. The application of the different model control units and the frequency selector switch used is shown in the following chart.

CONTROL UNIT MODELS	FREQ. SELECTOR SWITCH ADDED	NO. OF FREQ.
4EC69A10	none	one
4EC69A11	S703	Two
4EC69A12	S704	Three or four

Volume Control (R701)

Volume control R701 is a variable resistor used to control the audio output of the speaker (LS701). In Local/Remote combinations, R701 is replaced by a 3.5-ohm T-pad, R3001.

MONITOR/CG DISABLE (S702)

Placing S702 in the MONITOR position disables the noise squelch circuit in the receiver. In radios equipped with Channel Guard, the MONITOR position also disables the receiver Channel Guard. The CG DISABLE position of the switch disables Channel Guard while permitting normal noise squelch operation.

Multi-Frequency Switches (S703 and S704)

In multi-frequency applications, the frequency-selector switch selects the channel desired for both transmit and receive. The switch connects the emitter of the receiver first oscillator and the transmitter oscillator-switching diode to ground, so that the radio will operate on the frequency determined by the selected crystal-controlled oscillators. In multi-frequency radios, the transmitter and receiver Channel Guard operates on all frequencies.

Fan Option

An optional fan is available for mounting on the back of the control unit to provide ventilation for the transmitter and receiver. The fan is connected at the factory for continuous operation.

Clock Options

A 12-hour or 24-hour electric clock is available for mounting on the Control Unit. The clock is connected so that it will operate with the power switch On or Off. The clock can be set by turning the indicator wheels until the correct time shows in the window.

Tune-Up Meter Option

A 50 micro-amp tune-up meter (M1) and

12-position meter selector switch (S1) is available for mounting on the control unit. The switch connects to the transmitter and receiver centralized metering jacks by a "Y" cable with two plugs, and permits the following functions to be metered:

UNIT METERED	METERING SWITCH POSITION	FUNCTION METERED
Receiver (at J304)	RA	Discriminator
	RB	Lim 1
	RC	Lim 2
	RD	Oscillator
	RJ	Reg. 10V (Multiply meter reading by 5)
Transmitter (at J201)	TA	Mult-1
	TB	Mult-2
	TD	Mult-3
	TE	Mult-4
	TF	PA Grid
	TG	PA Plate

WARNING

The meter leads are at PA plate potential when the metering switch is in the TG position.

WALL MOUNT CONTROL UNIT

Control Unit Model 4EC70A10 is used with Wall Mount station combinations. The control unit is mounted on the system frame next to the power transformers.

The control unit contains the VOLUME control (R701), audio transformer (T701), MONITOR switch (S701), and the 3.5 ohm audio load resistor (R702) connected across TB701-1 and -2. R702 is removed when the speaker option is used, and the speaker is connected across TB701-1 and -2. Thermostats (S1 and S2) for the fan and heater options plug in to TB2.

Volume Control (R701)

The VOLUME control is set for not more than 2.7 Volts RMS at the audio pair (TB1 & -2) with ±3.3 kHz (Narrow Band) or ±10 kHz (Wide Band) deviation at 1000 Hz applied to the station antenna jack.

Monitor Switch (S701)

When the Wall Mount station is equipped with a speaker option, pressing down the MONITOR switch disables the noise squelch circuit in the receiver. If the radio is equipped with Channel Guard, pressing the MONITOR switch also disables the receiver Channel Guard.

CHANNEL GUARD

Channel Guard Board Model 4EK14B10 is a fully transistorized encoder-decoder for use with Desk Top and Wall Mount station combinations.

The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

Complete instructions for the encoder/decoder are contained in Maintenance Manual LBI-4143.

CARRIER CONTROL TIMER

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute timing cycle, and alerts the operator that the transmitter is off by means of an alarm tone in the speaker. The transmitter can be turned on again by releasing and rekeying the push-to-talk switch on the microphone. The timer option is assembled on a printed wiring board that mounts on the underside of the main chassis.

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. An optional potentiometer is available that permits the timing cycle to be adjusted from 15 seconds to 5 minutes. Complete instructions for the Carrier Control Timer are contained in Maintenance Manual LBI-4138.

REMOTE CONTROL

Remote Control Board Models 4CK18A14, 15, 16 and 17 were designed for use with Desk Top and Wall Mount stations in local/remote and remote applications. The remote control board permits a maximum of four remotely controlled operations by the application of two different levels and polarities of control current from a remote control console. The chart on this page shows the different functions available for each station, and the control current required to select each function.

AUDIO & CONTROL CIRCUITS

4KC18A14

Remote Control Board Model 4KC18A14 uses a 6-milliamp relay (K1) to switch a single-frequency station from receive to transmit. With no control current applied to the remote control board, the output of the station receiver (audio PA) is fed through normally closed contacts K1-11 and -12 through audio transformer T1 to the telephone audio pair (TB1-1 and -2).

FUNCTION	STATION	REMOTE CONTROL MODEL	FUNCTION SELECTED BY CONTROL CURRENT AT TB1-3			
			0mA	+6mA	+15mA	−6mA
1-Freq. Xmit & 1-Freq. Rec	Desk Top or Wall Mount	4KC18A14	Receive	Transmit		
1-Freq. Xmit & Rec with Chan Guard	Desk Top or Wall Mount	4KC18A15	Chan Gd Receive	Monitor (Chan Gd disabled)	Transmit	
2-Freq. Xmit & 1-Freq. Rec	Wall Mount only	4KC18A15	Receive	Transmit F1	Transmit F2	
1-Freq. Xmit & 2-Freq. Rec.	Wall Mount only	4KC18A16	Receive F1	Transmit		Receive F2
2-Freq. Xmit & 2-Freq. Rec.	Wall Mount only	4KC18A17	Receive F1	Transmit F1	Transmit F2	Receive F2

Keying the microphone at the remote control console applies 6 milliamps to the control pair (TB-3 and -4). This energizes relay K1 which switches the telephone line audio pair through K1-12 and -13 to the transmitter input, and switches the transmitter keying lead to ground through K1-6 and -7.

4KC18A15

Remote Control Board Model 4KC18A15 uses a 6 milliamp relay (K1) and a 15 milliamp relay (K2) connected in series to provide two-frequency transmit and one-frequency receive, or one-frequency transmit and receive with Channel Guard.

For two-frequency transmit and one-frequency receive, keying the microphone at the remote control console on the F1 channel applies 6 milliamps to the control pair, energizing relay K1. This switches the telephone line audio pair to the transmitter input through K1-12 and -13, and switches the transmitter keying lead (PTT) to ground through K1-6 and -7. The transmitter crystal keying lead is grounded through normally closed contacts K2-11 and -12.

Keying the microphone at the remote control console on the F2 channel applies 15 milliamps to the control pair, energizing relays K1 and K2. Relay K1 switches the audio pair to the transmitter input, and the transmitter keying lead to ground. Relay K2 switches the transmitter F2 crystal keying lead to ground through contacts K2-12 and -13.

With no control current at the control pair, neither of the relays is energized, and audio from the station receiver is coupled through T1 to the remote control console.

In Channel Guard applications, relays K1 and K2 are interchanged on the remote control board. Pressing the MONITOR switch at the remote control console applies 6 milliamps to the control pair, energizing relay K1 (in relay socket XK2). This grounds the anode end of squelch gating diode CR609 through K1-12 and -13 and disables the Channel Guard squelch circuits. The operation of the noise squelch circuit is not affected.

Pressing the TRANSMIT switch at the remote control console applies 15 milliamps to the control pair, energizing relay K2 (in relay socket SK1). This switches audio from the telephone line to the transmitter input, and switches the transmitter keying lead to ground.

4KC18A16

Remote Control Board Model 4KC18A16 uses two 6 milliamp relays K1 and K3 to provide a single-frequency transmit and two-frequency receive. Relay-polarizing diodes are installed in series with the relays for different polarities.

With no control current on the control pair, neither relay is energized and audio from the station receiver (F1) is coupled through T1 to the remote control console. When a negative 6 milliamp control current is applied to TB1-3 (with respect to TB1-4), current flows through CR2 and K3. Relay K3 energizes and switches ground from receiver oscillator F1 to receiver oscillator F2.

If a positive 6 milliamp control current is applied to TB1-3 (with respect to TB1-4) current flows through CR1 and K1. Relay K1 energizes and switches the audio pair to the transmitter input, and the transmitter keying lead to ground.

4KC18A17

Remote Control Board Model 4KC18A17 uses two 6 milliamp relays (K1 and K3) and a 15 milliamp relay (K2) to provide two-

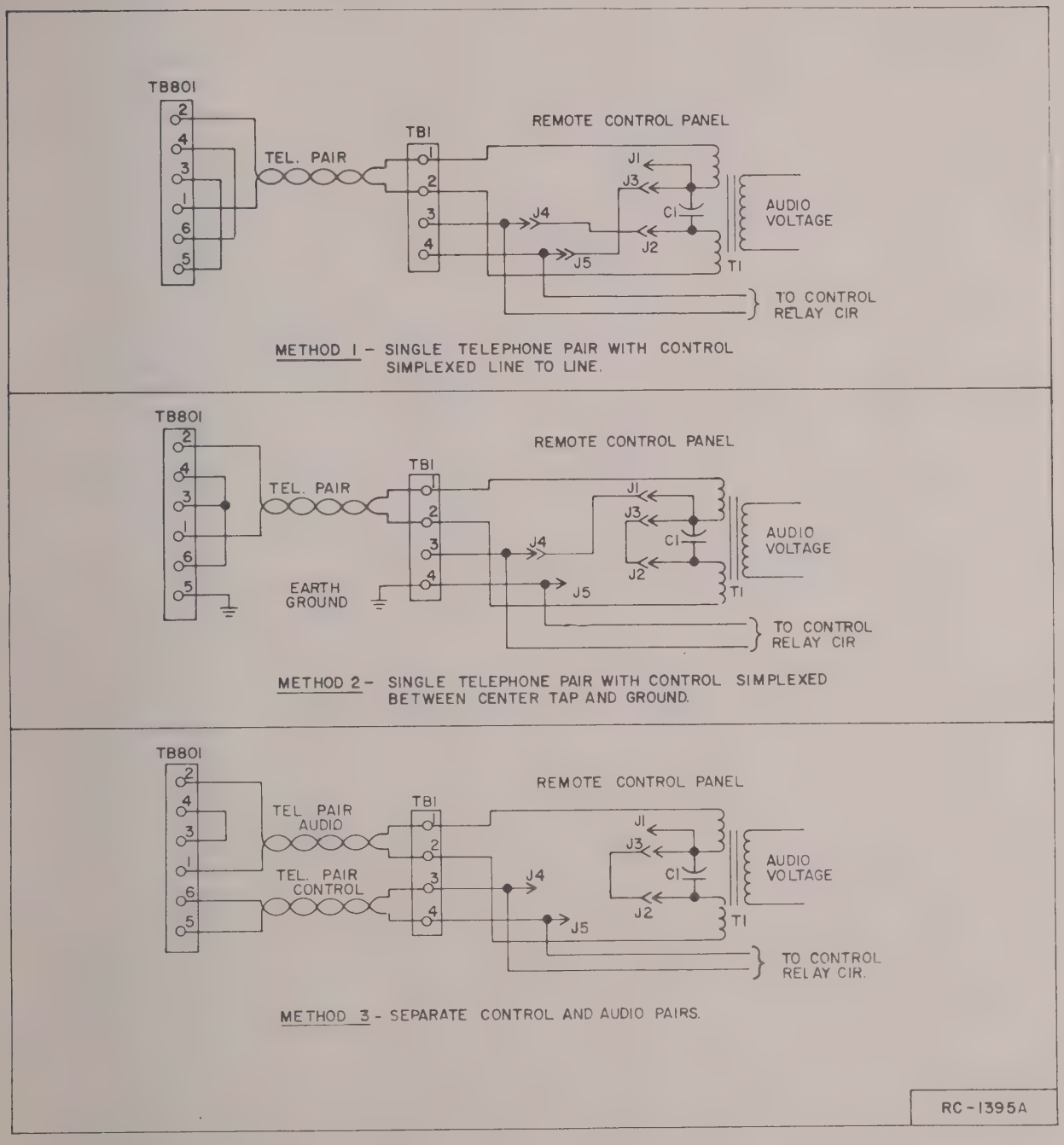


Figure 6 - Telephone Line Connections

frequency transmit and two-frequency receive. K1 and K2 are connected to series with relay polarizing diode CR1 and K3 is connected in series with CR2.

Keying the microphone at the remote control console on the F1 channel applies +6 milliamps to TB1-3 (with respect to TB1-4), energizing relay K1. This switches the telephone line audio pair to the transmitter input through K1-12 and -13, and switches the transmitter keying lead (PTT) to ground through K1-6 and -7. The transmitter crystal keying lead is grounded through normally closed contacts K2-11 and -12.

Keying the microphone at the remote control console on the F2 channel applies 15 milliamps to the control pair, energizing relays K1 and K2. Relay K1 switches the audio pair to the transmitter input, and the transmitter keying lead to ground. Relay K2 switches the transmitter F2 crystal keying lead to ground through contacts K2-12 and -13.

With no control current at the control pair, no relay is energized, and audio from the station receiver (F1) is coupled through T1 to the remote control console. The F1 receiver oscillator is grounded through normally closed contacts 11 and 12 of K3.

When a negative 6 milliamp control current is applied to TB1-3 (with respect to TB1-4) current flows through CR2 and K3. Relay K3 energizes and switches ground from receiver oscillator F1 to receiver oscillator F2 through normally closed contacts 11 and 12 of K2.

CONTROL METHODS

Three types of telephone line connections are commonly used in remote control applications. The remote control board is normally shipped with jumpers connected for operation with a single telephone pair with control simplexed line to line (Method 1). Refer to Figure 6 for the three types of telephone line and jumper connections.

Before choosing one of these methods, consider both the cost and performance of each, as one method may be available at a considerably lower rate. Some local telephone companies offer no choice, but will provide only an audio pair and a control pair. The chart on page 15 contains information to assist in selecting the control method and type of telephone line to be leased.

ADJUSTMENT PROCEDURE

Before setting the Mic Level Adjust (R1) on the remote control board, make sure that all power line, phone line and ground connections have been completed at the station and the remote control console. Also, the station should be aligned, and in wall Mount Stations, VOLUME Control R701 (on Wall Mount Control Unit Model 4EC70A10) set for not more than 2.7 Volts RMS at the audio pair (TB1-1 & -2) with ±3.3 kHz (Narrow Band) or ±10 kHz (Wide Band) deviation at 1000 Hz applied to the station antenna jack. In Desk Top stations (Local/Remote control), adjust R3002 (on back of the power supply) for 2.7 Volts RMS at the audio pair.

To set the Mic Level Adjust:

1. Apply a 1000 Hz signal to the microphone jack on the remote control console (use a 30 milli-Volt signal level for the Transistorized Control Console, or a 50 milli-Volt signal level for the RC4.

2. Key the transmitter from the remote control console and set Mic Level Adjust R1 for 0.? Volt measured across TB3-18 and -19 with an AC-VTVM.

LOCAL/REMOTE CONTROL MODIFICATION (19A127258G1)

In Local/Remote control applications (Desk Top station), T-pad R3001 (3.5 ohms, GE Part No. 19B209423P1) replaces the standard volume control R701. The T-pad controls loudspeaker volume, but does not affect line level. Variable resistor R3002 (5K-ohms, GE Part No. 5496870P22) is installed on the power supply adjacent to MIC jack J502 for adjusting the receiver output to the line and to the T-pad for the loudspeaker (See Figure 7).

SERVICE INTERCOM

A serviceman at the station can communicate with the operator of the remote control console by keying the station transmitter while holding down the PUSH-TO-NET switch (S501 on the power supply chassis). Holding down S501 feeds audio from the exciter board through the receiver and on to the audio pair. The message is also transmitted by the station.

The serviceman can receive a message from the remote control console by holding down the PUSH-TO-NET switch while the operator of the console keys the transmitter. This message is also transmitted by the station.

Method	Description	Advantage or Disadvantage
1	One metallic pair: for both audio and control voltages with control voltage simplexed from line to line.	Economical; dependable where earth currents may be large, or where a good earth ground cannot be obtained; keying clicks will be heard in paralleled Remote Control Units.
2	One metallic pair: for both audio and control voltages with control voltage simplexed from line to ground.	Economical; earth ground currents (encountered near power company sub-stations) may interfere with control functions; keying clicks minimized.
3	Two telephone pairs; one for audio voltage and one for control voltage	Provides best performance; keying clicks will not be heard; least susceptible to earth ground currents which may interfere with control functions.

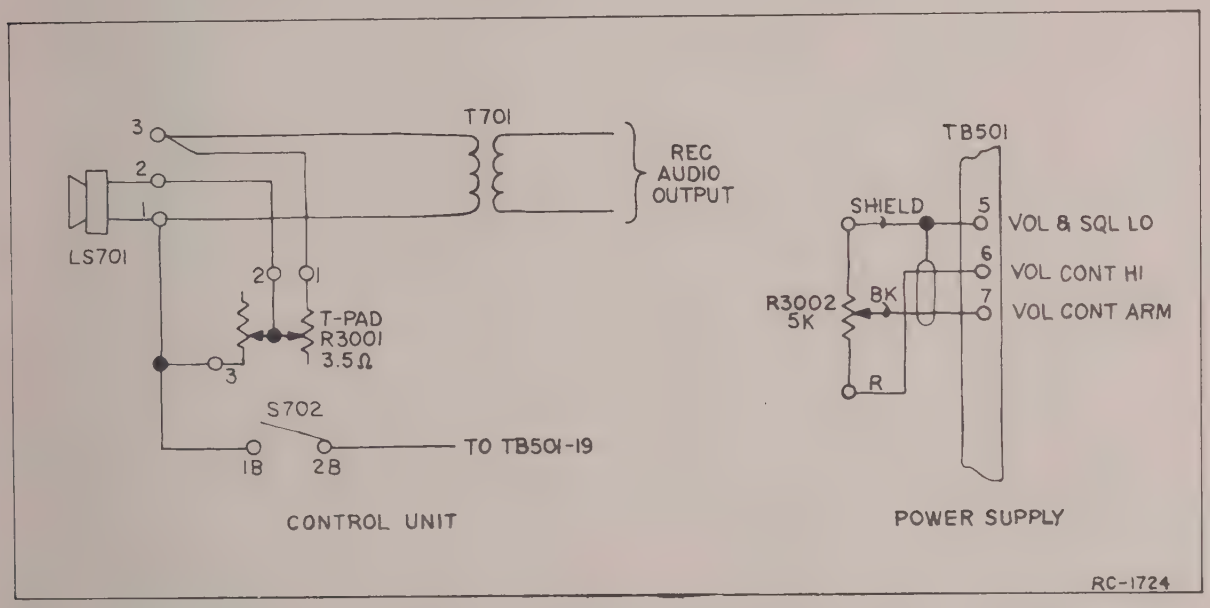


Figure 7 - Circuit Modifications for Local/Remote Control

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R110) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause over-modulation are clipped by the modulation limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. Audio Oscillator Model 4EX6A10
2. Frequency Modulation Monitor
3. AC VTVM or output meter
4. G-E Test Set Model 4EX3A10 (TM11 or TM12)

PROCEDURE

Transmitters without CHANNEL GUARD

1. Connect the audio signal generator and the meter across audio input terminals J5 (green-hi) and J6 (black-lo) on G-E Test Set, or across J201-15 (mike hi) and J201-7 (mike lo) on the Centralized Metering Jack.
2. Apply a 1.0 volt signal at 1000 Hz to Test Set or across J201-15 and J201-7 on the Centralized Metering Jack.
3. Set MOD ADJUST (R110) for a 4.5 KHz (Narrow Band) or 13.5 KHz (Wide Band) swing with deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.

Transmitters with CHANNEL GUARD

1. Set the Channel Guard TONE ADJUST (R643) for 0.75 KHz tone deviation.
2. Follow Steps 1 thru 3 described above.

Multi-frequency Transmitters

Check all channels for deviation as described in Steps above.

ALIGNMENT PROCEDURE CHANGES FOR 10-WATT RADIO COMMON CARRIER DISPATCH STATIONS WITH TRANSMITTER TYPE ET-74-C (Option 8450)

In this service, FCC regulations restrict the transmitter power output to 10 watts. Whenever MASTR Desk Top Stations are used in such services, make the following changes in the transmitter Alignment Procedure (RC-1411 in LBI-3737):

In Steps 9, 11, 13 and 14 of the Alignment Procedure, adjust the PA LOADING for a watt meter output of 10 watts and note the Test Meter reading. This reading will indicate the correct PA loading. If a watt meter is not available, adjust the PA LOADING for a meter reading of 0.32 volt (instead of 0.7 volt).

NOTE

The following changes were made in the station for 10-watt operation:

- In the PA assembly, the PA screen grid resistor (R213) was changed from 8.2K to 22K.
- In the power supply, the jumpers between TB4-14 and -18, and TB4-12 and -15 were removed. The jumpers between TB4-14 and -19, and TB4-8 and -15 were added.
- Changed transmitter type number to ET-74-C.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA plate voltage and plate current indication, and using the following formula:

$$P_i = \frac{\text{Plate Voltage} \times \text{Plate Current Indication}}{4.3}$$

where

P_i is the power input in watts.

Plate voltage is measured with G-E Test Set in Position G, using the 1000-volt scale (or measured from J201-1 to -16 with multimeter).

Plate current indication is measured with G-E Test Set in Position G, using the TEST 1 scale (or measured from J201-1 to -9 with multimeter).

4.3 is the value of the plate current metering resistor in ohms.

FOR OPERATING AT REDUCED POWER

In some services, FCC regulations do not permit the use of full rated power input to the final amplifier plate circuit (ET-74-A or ET-74-B). In such cases, the PA LOADING control must not be adjusted for a meter reading of 0.79 at J201 as shown in Step 13 of the Alignment Procedure.

To find the maximum permissible meter reading at J201, measure the PA plate voltage under load and derive the meter reading from the following formula:

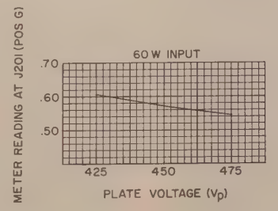
$$V_{meter} = \frac{4.3 \times P}{V_p}$$

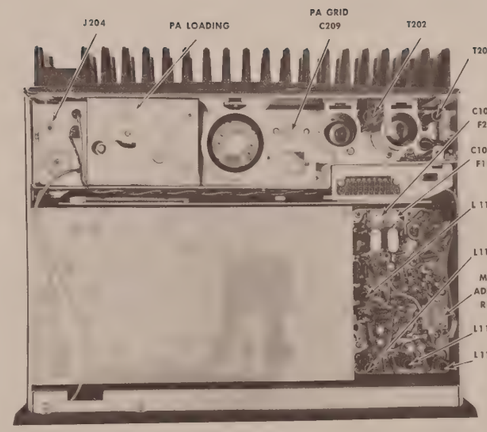
Where V_{meter} is the maximum permissible test set reading (position G for G-E Test set, or J201-1 and -9 with multimeter):

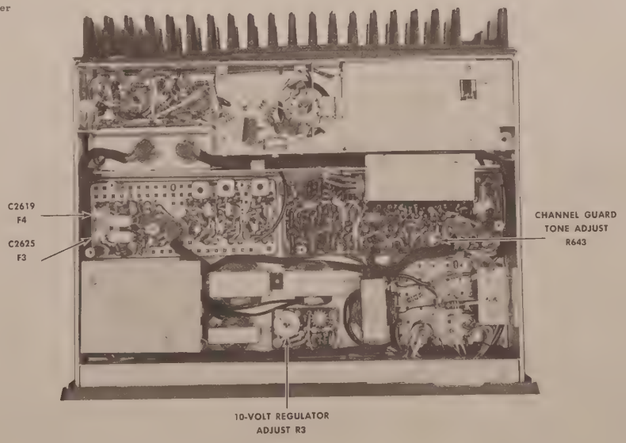
P is the maximum permissible power input

V_p is the measured plate voltage under load

The maximum permissible J201 reading vs plate voltage for a power input of 60 watts is shown in the following chart.







TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. General Electric Test Set TM11 or TM12 or a 20,000 ohms-per-volt Multimeter with a 1-volt scale, 50-ohm wattmeter, and frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

2. Place crystal(s) in crystal socket(s). (Crystal frequency = operating frequency ÷ 24)
3. Turn PA LOADING to minimum loading position, set crystal trimmer C101 to mid-capacity.
4. For multi-frequency transmitters, set all trimmers to mid-capacity and set the Control Unit CHANNEL SELECTOR Switch to the highest frequency channel.
5. Place the TUNE-OPERATE Switch (S201) in the TUNE position.
6. For a large change in frequency or a badly mis-aligned transmitter, above 150 MHz, turn the slugs in the Exciter coils (L113, L114, L115, L116) to the bottom of the coil. (For transmitters below 150 MHz, set the slugs in the center of the coils.) Set the T201 slug to the top of the coil. Set the T202 top slug to the top of the coil and the bottom slug to the bottom of the coil.
7. Connect TEST SET to the Transmitter Centralized Metering Jack J201. Turn the test set polarity switch to (+). If using a multimeter, connect the leads as shown below.
8. Connect wattmeter to J204.
9. With TEST SET in position I, key the transmitter and check for a regulated 10 volts (read on 15-volt scale). If voltage is not correct, adjust 10-volt regulator potentiometer R3 for 10-volts. Then move TEST SET plug to receiver metering jack and check 10-volts at Position J. If reading is not approximately 10 volts, refer to the Power Supply Troubleshooting Diagram.
10. All adjustments are made with the transmitter keyed and the TEST SET on the 1-volt TEST scale.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A MULT-1	pin 10 (+) pin 16 (-)	L113 & L114	SEE Procedure	Carefully tune L113 for maximum meter reading, then tune L114 for a small dip in meter reading.
2.	B MULT-2	pin 2 (+) pin 16 (-)	L115, L114 and L116	See Procedure	Tune L115 and re-tune L114 for maximum meter reading, then tune L116 for a dip in meter reading.
			MULT-3 AND POWER AMPLIFIER		
3.	D MULT-3	pin 16 (+) pin 4 (-)	T201 & L116	Maximum	Adjust T201 for maximum meter reading, then re-adjust L116 maximum meter reading.
4.	E MULT-4	pin 16 (+) pin 5 (-)	T202	Maximum	Adjust top slug of T202 for maximum meter reading. Adjust bottom slug of T202 for maximum meter reading, then re-adjust top slug for maximum meter reading.
5.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID C209	Maximum	Tune C209 for maximum meter reading.
6.	G PA PLATE	WARNING High B+ on pins 1 & 9 pin 1 (+) pin 9 (-)	PA PLATE (C214)	See Procedure	Carefully tune PA Plate for minimum meter reading. Adjustment is quite sharp and will be only a small dip in meter reading.
7.					Place TUNE OPERATE Switch S201 in the OPERATE position.
8.	G PA PLATE	pin 1 (+) pin 9 (-)	PA PLATE		Carefully re-tune PA Plate for minimum meter reading.
9.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	0.7 volts	Adjust PA LOADING for meter reading of 0.7 volts.
10.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING C215	Maximum	Adjust ANT TUNING for maximum meter reading.
11.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING AND ANT TUNING	See Procedure	Re-adjust PA LOADING for 0.7 volts. Re-adjust ANT TUNING for maximum meter reading.
12.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID	Maximum	Repeak PA GRID for maximum meter reading.
13.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	0.79 volts	Increase PA LOADING until meter reads 0.79 volts.
14.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING	Maximum	Repeak ANT TUNING, then repeat Step 13 and repeak ANT TUNING.
			FREQUENCY ADJUSTMENT		
15.			C101 (C102 in 2-freq. units, and C2623 or C2619 in multi-freq. units.		Loosely couple frequency counter to output and adjust C101 for proper frequency output. (Switch to F2 and adjust C102 on 2-frequency units. In 3- or 4-frequency units, adjust C2623 or C2619 as required. NOTE For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approximately 75° F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.

ALIGNMENT PROCEDURE

TRANSMITTER TYPES

ET-74-A, B, C & E

RC-1411H

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, low B plus, tone and voice deviation, defective audio sensitivity and modulator adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

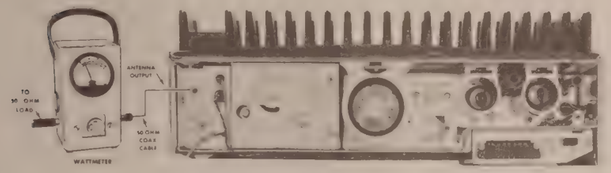
1. Wattmeter similar to:
   - Bird #43
   - Jones #711N
2. VTVM similar to:
   - Triplett #850
   - Heath #1M-21
3. Audio Generator similar to:
   - GE Model 4EX6A10
   - Heath #1G-72
4. Deviation Meter (with a .75 kHz scale) similar to:
   - Measurements #140
   - Lampkin #205A
5. Multimeter similar to:
   - GE METERING TEST SET MODEL 4EX3A10 or Triplett #631 or 20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below:



2. Key transmitter and check wattmeter for minimum reading of 35 watts (132-162 MHz) or 30 watts (162-174 MHz) in ET-74-A & B, or 10 watts in ET-74-C.

SERVICE CHECK

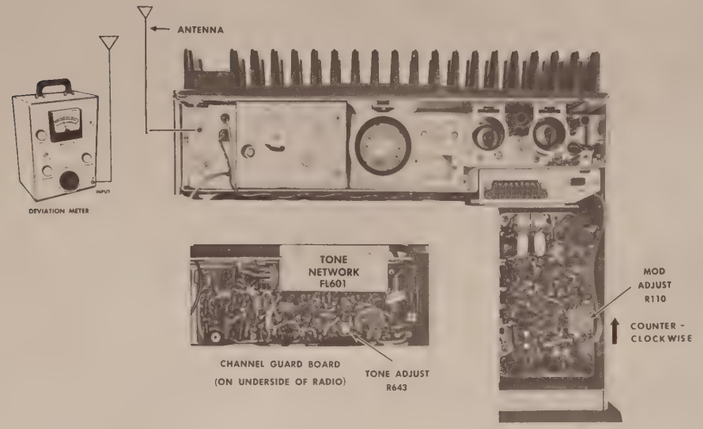
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Setup Deviation Meter and monitor output of transmitter as shown below:



2. Set MOD ADJUST control R110 fully counterclockwise.

3. Key transmitter and check for 0.75 kHz deviation. If reading is low or high, adjust Channel Guard TONE ADJUST (R643 on Channel Guard Board) for a reading of 0.75 kHz.

DEVIATION METER

NOTES:

1. On units supplied with Channel Guard, the Phase Modulator Tuning should be peaked carefully to insure proper performance. (Refer to Step 1 in the Transmitter Alignment Chart).

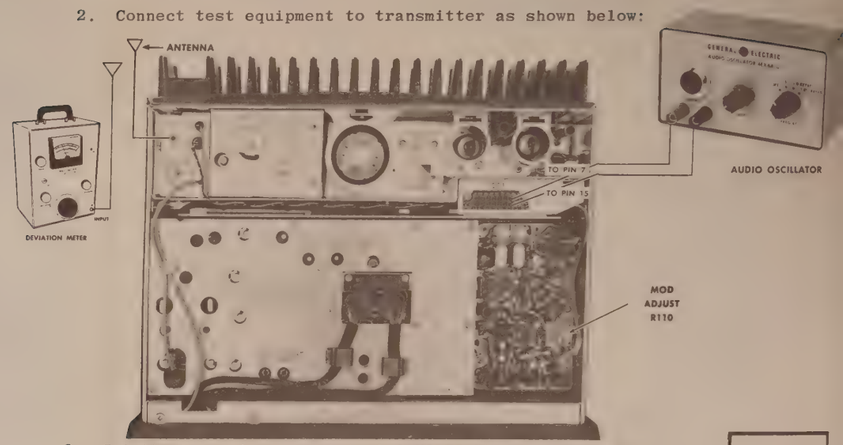
2. The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the microphone.
2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 1.0 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter by connecting a jumper from J201-18 to J201-16 (GRD). Then adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz (Narrow Band) or 13.5 kHz (Wide Band).
6. Adjust MOD ADJUST Control R110 until deviation reads 4.5 kHz (Narrow Band) or 13.5 kHz (Wide Band) on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

DEVIATION METER

NOTES: --These transmitters are adjusted for 4.5 kHz (13.5 kHz Wide Band) deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz (15 kHz Wide Band) under the worst conditions of frequency, voltage and temperature.

If the deviation reading plus (+) and minus (-) differs by more than 0.5 kHz (1.5 kHz Wide Band) check the following:

1. Recheck Step 1 as shown in the Transmitter Alignment Chart.
2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz (10 kHz Wide Band). Voltage should be LESS than 90 millivolts (typically 75 mv).

METER

FRONT END ALIGNMENT

These instructions are for tuning the oscillator and RF stages of the receiver and may be used when changing the receiver crystal or frequency. When necessary to realign the entire receiver, refer to the COMPLETE RECEIVER ALIGNMENT.

EQUIPMENT REQUIRED

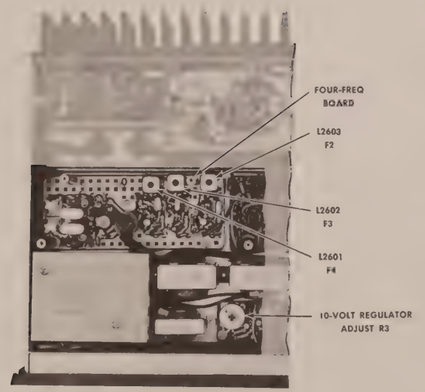
1. GE Test Set TM11 or TM12 (or 20,000 ohms-per-volt Multimeter).
2. 130-174 MHz signal source (keep signal level below saturation).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set 4EX3A10 into receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to 1. If using Multimeter, connect the negative lead to J304-13 (ground).
2. Turn SQUELCH control (R400) fully clockwise and VOLUME control to minimum. Switch to position "Q" (or measure at J304-9 with Multimeter) and adjust PA Bias R392 for a reading of 0.28 volts (500 milliamps).

ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	Multimeter + at J304	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L307	See Procedure	Switch to F1, put in F1 crystal and tune L307 for maximum meter reading.
2.	D OSC	pin 4	L309 & L307	Maximum (.05 - .25)	Apply an on-frequency signal to J301 and adjust L309 and L307 for a maximum meter reading (.06 - .25 Volts).
3.	E OSC	pin 4	L310, L317 & L311	Maximum	Adjust L310, L317 & L311 for maximum.
4.	D OSC	pin 4	L308 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust L308 for maximum.
5.					Preset RF capacitors C301, C304, C307, C311, C315, and C318 to approximate-frequency. (Capacitors tune from 130 MC (max. capacitance) to 174 MC (min. capacitance).
6.	C LIM 2	pin 3	L310, L311 C301, C304 C307, C311 C315, C318	Maximum	Apply on-frequency signal to J301. Tune L310, L311, C301, C304, C307, C311, C315, and C318 for maximum meter reading. Keep signal below saturation at each stage on discriminator zero.
7.	A DISC	pin 10	L307 (L308 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. - NOTE - For proper freq control of the receiver, it is recommended that all freq adjustments be made when the equipment is at a temp of approx 75°F. In no case should freq adjustments be made when the equipment is outside the temp range of 50° to 90°F.
8			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
SQUELCH ADJUSTMENT					
9.				30°	Set SQUELCH Control (R400) to open with a 4 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)



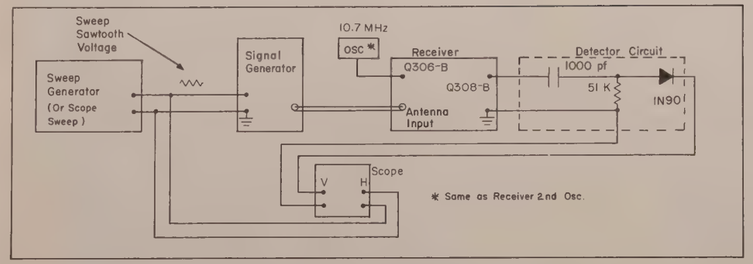


Figure 1 - High and Low IF FILTER TEST Circuit

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set TM11 or TM12 (or 20,000 ohms-per-volt Multimeter).
2. A 10.7MHz (±200 Hz) and 130-174MHz signal source. Couple the 10.7MHz signal through a 0.01 uf capacitor. Keep signal levels below saturation.
3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 10.7 MHz marker generator and construct a detector circuit (see Figure 1 for circuitry).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set into the receiv or centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to TEST 1. If using multimeter, connect the negative lead to J304-13 (ground).
2. Switch Test Set to Position "I" (or measure at collector of Q318 with multimeter). Reading should be a nominal 13.8 volts.
3. Switch to Position "J" (or measure at top of C443 with multimeter), and check for a reading of 10 volts. If reading is not correct, refer to STEP 8 of the Transmitter Preliminary Checks and Adjustment Procedure.
4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "Q" (or measure at J304-9 with multimeter) and adjust PA Bias potentiometer R392 for a reading of 0.28 volts (500 milliamps).

ALIGNMENT PROCEDURE

STEP	METERING TEST SET 4EX3A10	POSITION MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
DISCRIMINATOR					
1.					Remove 1st oscillator crystal and apply a 10.7 MHz signal to the base of Q308.
2.	A DISC	pin 10	L329	See Procedure	Adjust L329 (discriminator primary) 1/2 turn up from bottom of range.
3.	A DISC	pin 10	L330	Zero	Tune L330 (discriminator secondary) for zero meter reading.
HIGH and LOW IF FILTER (SEE NOTE 1)					
4.	B LIM	pin 2	L321 thru L328	Maximum	Adjust L321 thru L328 for maximum meter reading.
5.	B LIM	pin 2	C357, C354, C350	See Procedure	Adjust C357 for minimum meter reading. Adjust C354 for maximum meter reading. Adjust C350 for minimum meter reading.
6.			C357 & C360		Disable the 2nd oscillator by grounding base of Q307 through a .01 µf capacitor. Connect scope, signal generator and detector as shown in Figure 1. Sweep RF 550KHz's at 20 Hz. Connect 10.7 MHz marker to gate of Q306. Tune C357 and C360 for scope pattern shown. Keep marker signal centered between humps and signal level below saturation.
7.			L321 thru L328		Disconnect detector, remove short from base of Q307 and connect scope to 1st LIM test point. Adjust L321 thru L328 for symmetrical wave form shown, with marker in center.
8.	A DISC	pin 10			Check to see that discriminator idling voltage is within 0.05 volts of zero with no signals applied and the modulation acceptance bandwidth is greater than ±8 KHz (narrow band) or ±16 KHz (wide band).
OSC/MULT & AMPLIFIER					
9.	D OSC	pin 4	L307	Maximum	Remove short from base of Q307, if present, then insert 1st oscillator crystal and adjust L307 for maximum meter reading.
10.	D OSC	pin 4	L309 & L307	Maximum (.06-.25 V)	Adjust L309 and L307 for maximum meter reading (.06-.25 Volts).
11.	E OSC	pin 4	L310, L317 L311	Maximum	Adjust L310, L317 and L311 for maximum.
12.	D OSC	pin 4	L308 (2-freq)	Maximum	For 2-frequency receiver, insert F2 crystal and adjust L308 for maximum meter reading.
RF					
13.	C LIM 2	pin 3	L221, L322, L323, L324, L325, L326, L327, L328	Maximum	Inject 10.7 MHz crystal-controlled marker on base of 2nd Mixer Q308. Adjust L321, L322, L323, L324, L325, L326, L327, L328 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero. Remove 10.7 MHz marker.
14.	C LIM 2	pin 3	C350, C354, C357, C360	Maximum	Inject 10.7 MHz crystal-controlled marker to gate of Q306. Adjust C350, C354, C357 and C360 for maximum meter reading. Adjust C350 for dip on "D" position of test meter.
15.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
FREQUENCY ADJUSTMENT					
16.	A DISC	pin 10	L307 (L308 for 2-freq. or L2603, L2602 or L2601 on 4-freq. board for 3- or 4-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. In 3- or 4-frequency units, tune L2603, L2602 or L2601 as required. NOTE 2 For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approx. 75° F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.
17.				30°	Set SQUELCH Control (R400) to open with a 4 db SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

NOTE 1 -- High and Low IF coils and capacitors have been set at the factory and will normally require no further adjustment. Do not re-align unless there is positive evidence of a defective filter. For location of components refer to the Receiver Outline Diagram.

ALIGNMENT PROCEDURE

RECEIVER MODELS 4ER48C10-15

RC-2162B

TEST PROCEDURES

These Test Procedures are designed to help you to service a receiver that is operating--but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:

  Heath IM-12

- Signal Generator similar to:

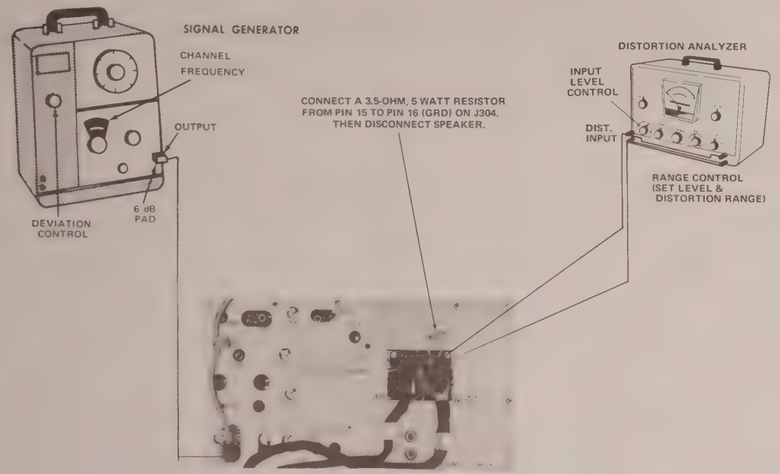
  Measurements M-800

- 6-dB attenuation pad, and 3.5 ohm,

  5-watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the test equipment and let it warm up for 20 minutes.



STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Connect a 1,000-microvolt test signal modulated by 1,000 hertz with +3.3 kHz deviation to the antenna jack J301.

B. When speaker is used, disconnect speaker (and handset if present). Hook up a 3.5-ohm load resistor from J304-15 to J304-16 as shown.

C. Set VOLUME Control for two-watt output (2.65 VRMS).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all control and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than two watts, make the following checks:

E. Battery and regulator voltage--low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. DC Bias Adjust R392 (Position "G" on Test Set) --- should be adjusted for 0.28 volts (500 milliamps). (Refer to Receiver Alignment on reverse side of page).

G. Audio Gain (Refer to Receiver Troubleshooting Procedure).

H. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.3-kHz deviation to J301.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (Filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least one watt (1.87 volts RMS across the 3.5-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD specification, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator Output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±8 kHz (but less than ±10 kHz).

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

PARTS LIST

LBI-3719E

132-174 MHz TRANSMITTER
TYPE ET-74-A NARROW BAND
TYPE ET-74-B WIDE BAND
TYPE ET-74-E 8-FREQ.

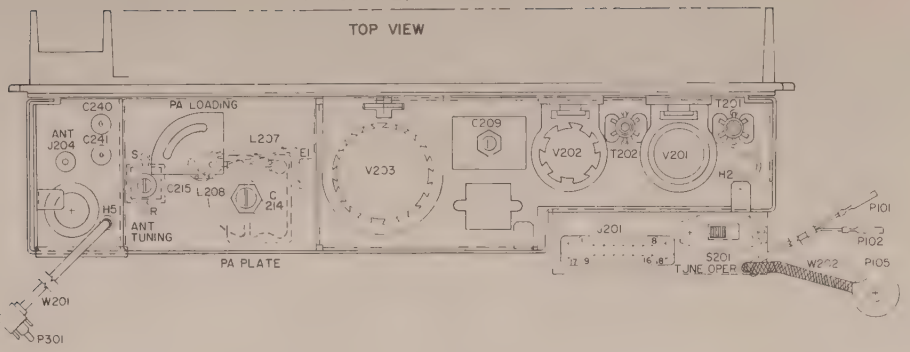
SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD WITH CHANNEL GUARD
		MODEL 4EG21F10 1 FREQ NARROW BAND REV B MODEL 4EG21F11 2 FREQ NARROW BAND REV B MODEL 4EG21F12 1 FREQ WIDE BAND REV B MODEL 4EG21F13 2 FREQ WIDE BAND REV B
		CAPACITORS
C101 and C102	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C103 and C104	5496219P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C105 thru C108	19C300685P93	Ceramic disc. 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C109 and C110	5496219P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C111 and C112	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113	5496372P167	Ceramic disc: 510 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C114	5490006P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C115	4029003P4	Silver mica: 680 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C116	5494481P131	Ceramic disc: 6800 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C117	5496219P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C118	5496372P45	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -2200 PPM.
C119	5490008P135	Silver mica: 220 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	5496219P218	Ceramic disc: 56 pf ±10%, 500 VDCW, temp coef -80 PPM.
C122* and C123*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV B and earlier:
	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C124 and C125	5496219P261	Ceramic disc: 82 pf ±5%, 500 VDCW, temp coef -80 PPM.
C126	7130348P3	Molded, phen: 1 pf ±.05 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32.
C127	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C128	5494481P113	Ceramic disc: 2000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C129	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C130	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C131	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C132	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C133	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C134	5496267P9	Tantalum. 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C135	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C136	7491395P114	Ceramic disc 2200 pf ±10%, 500 VDCW; sim to RMC Type JL.
C137 and C138	7491395P109	Ceramic disc: 1000 pf ±10%, 500 VDCW, sim to RMC Type JL.
C142*	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
		DIODES AND RECTIFIERS
CR101 and CR102	19A115603P1	Silicon.
CV101	5495769P9	Silicon, capacitive.
		JACKS AND RECEPTACLES
J101 thru J104	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J105	19B209303P1	Connector, phen: 9 pins.
J2003		(Part of printed board 19C303H35P1).
		INDUCTORS
L113	19C303883G13	Coil. Includes tuning slug 5491798P2.
L114	19C303883G14	Coil Includes tuning slug 5491798P2.
L115	19C303883G15	Coil Includes tuning slug 5491798P2.
L116	19C303883G17	Coil. Includes tuning slug 5491798P2.
		In Models earlier than REV A:
	19C303883G16	Coil. Includes tuning slug 5491798P2.
		TRANSISTORS
Q101	19A115889P1	Silicon, NPN
Q102 and Q103	19A115123P1	Silicon, NPN
Q104	19C300114P1	Silicon, NPN; sim to Type 2N706.
Q105	19A115330P1	Silicon, NPN.
Q106 and Q107	19A115328P1	Silicon, NPN
		RESISTORS
R101*	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w. Deleted by REV B.
R102	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R103	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R104 and R105	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R106	3R77P565J	Composition: 5.6 megohms ±5%, 1/2 w.
R107	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R108	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R109	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R110	19B209358P106	Variable, carbon film: 75 to 10,000 ohms ±10%, 1/4 w; sim to CTS Type X-201.
R111	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R112	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R113	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R114*	3R77P333J	Composition: 33,000 ohms ±5%, 1/2 w. Deleted by REV B.
R115*	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w. Deleted by REV B.
R116 and R117	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R118 thru R120	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R121	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R122	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R123	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R124	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R125*	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
		In Models of REV A and earlier:
	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R126	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R127	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R128	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R129	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R130*	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		In REV B and earlier:
	3R77P151K	Composition: 150 ohms ±10%, 1/2 w.
R131	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R132	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R133*	3R77P430J	Composition: 43 ohms ±5%, 1/2 w.
		In REV B and earlier:
	3R77P560K	Composition: 56 ohms ±10%, 1/2 w.
R135	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R136	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R138	3R77P753J	Composition: 75,000 ohms ±5%, 1/2 w
R140	3R77P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R164*	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w. Added by REV B.
R165*	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w. Added by REV B.
R166*	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w. Added by REV B
		THERMISTORS
RT101 and RT102	19B209353P2	Disc: 460 ohms max; sim to GE 16D-3121.
RT103 and RT104	19B209353P1	Rod: 10,200 ohms min; sim to GE 1R-1544.
		SOCKETS
XY101 and XY102		Refer to Miscellaneous Parts.
		CRYSTALS
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
		Crystal freq = Operating Freq. / 24
Y101 and Y102	19B206204P1	Quartz: freq range 5400-7250 KHz, temp range -30°C to +85°C.
		MISCELLANEOUS
	4033089P1	Clip. (Part of XY101, 102).
	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY101, 102).
	19C311172P1	Socket, crystal. (Part of XY101, 102).
	19B200525P9	Rivet. (Part of XY101, 102).
		POWER AMPLIFIER
		MODEL 4EF32F10 132-150.8 MHz REV B MODEL 4EF32F11 150.8-174 MHz REV B
		CAPACITORS
C202	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

(Cont'd on back of RC-1414)

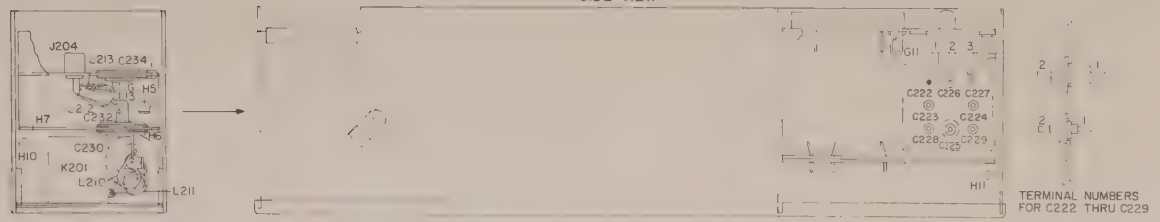
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PA ASSEMBLY 4EF32F10

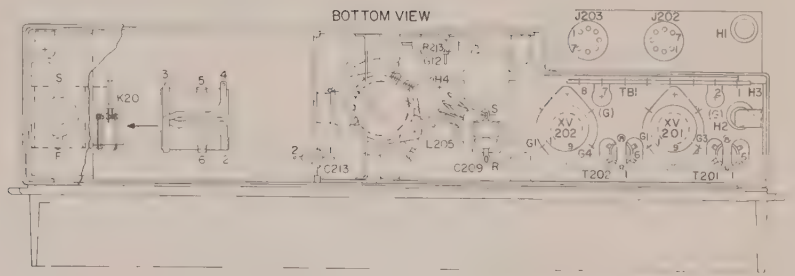
TOP VIEW



SIDE VIEW



BOTTOM VIEW



EXCITER BOARD 4EG21F10,11

RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR OR TUBE PINS TO GROUND WITH A 20 000 OHM PER VOLT METER AND WITH ALL POWER TURNED OFF. READINGS ON THE EXCITER BOARD OVER 1 000 OHMS READ ON THE X 1 000 SCALE. + OR − SIGNS SHOW METER LEAD GROUNDED.

EXCITER BOARD

TRANSISTOR SYMBOL #	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q101	650	650	13 200	3 650	8600	2800
Q102			8 600	2 800	12 000	2800
Q103			12 000	3 800	10	
Q104	1000	1000	14 000	3 500	25	
Q105			35 000	3 300	43	
Q106	150	150	4 300		25	2900
Q107	50	50			2600	2800

PA ASSEMBLY

								80	100K	47K	100		
	6K	220	47K	FIL	FIL	220	27K	47K	220				
			20K	20K	10K	0	22K		0	6K	22K	1K	

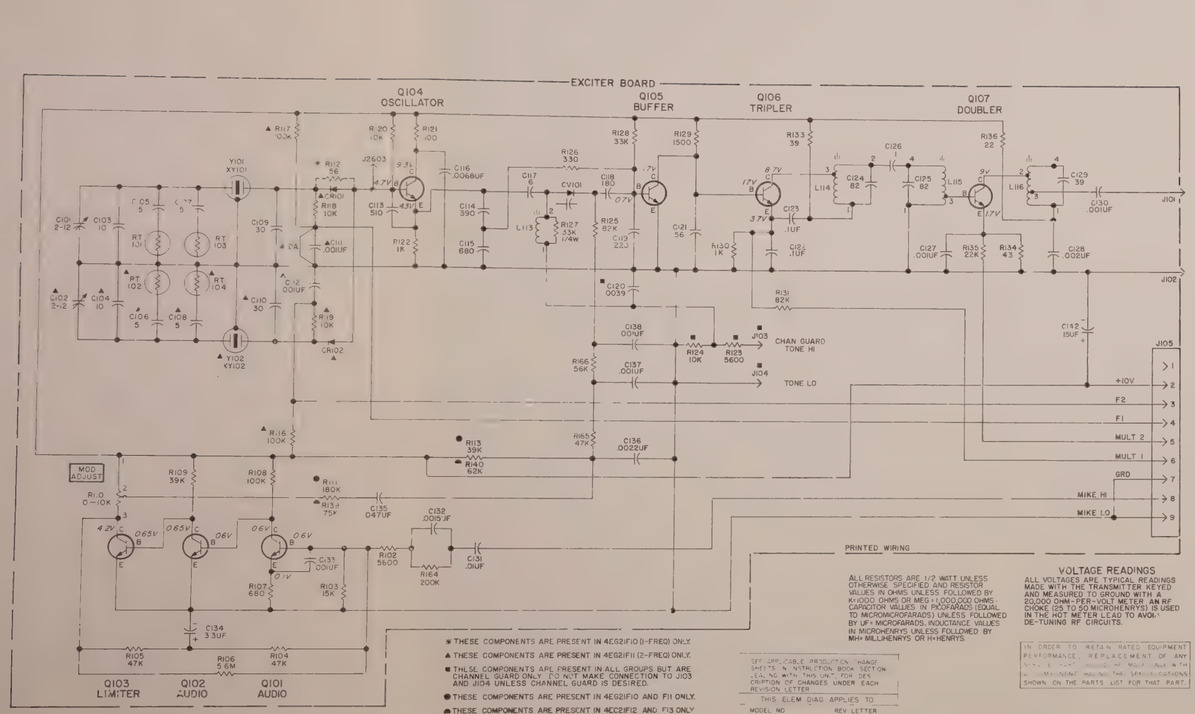
(19D402815, Rev. 5)
(19B205178, Sh. 1, Rev. 1)
(19B205178, Sh. 2, Rev. 1)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

132—174 MHZ TRANSMITTER
TYPES ET-74-A, B & E

RC-1413H


EXCITER BOARD
Q104 OSCILLATOR
Q105 BUFFER
Q106 TRIPLER
Q107 DOUBLER
Q103 LIMITER
Q102 AUDIO
Q101 AUDIO
MOD ADJUST
PRINTED WIRING
TONE HI
TONE LO
CHAN GUARD
+10V
F2
F1
MULT 2
MULT 1
GRD
MIKE HI
MIKE LO
VOLTAGE READINGS
ALL VOLTAGES ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED AND MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER. AN RF CHOKE (25 TO 50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DE-TUNING RF CIRCUITS.
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS, INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS
✱ THESE COMPONENTS ARE PRESENT IN 4EG21F10 (I-FREQ) ONLY.
▲ THESE COMPONENTS ARE PRESENT IN 4EG21F11 (2-FREQ) ONLY.
■ THESE COMPONENTS ARE PRESENT IN ALL GROUPS BUT ARE CHANNEL GUARD ONLY. TO NOT MAKE CONNECTION TO J103 AND J104 UNLESS CHANNEL GUARD IS DESIRED.
● THESE COMPONENTS ARE PRESENT IN 4EG21F10 AND F11 ONLY.
▲ THESE COMPONENTS ARE PRESENT IN 4EC21F12 AND F13 ONLY
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER
THIS ELEM DIAG APPLIES TO
MODEL NO REV LETTER
4EG21F10 C
4EG21F11 C
(19D402586, Rev. 8)
DOUBLER V201 XV201 8106
DOUBLER/DRIVE V202 XV202 8106
PA V203 XV203 7984
MULT 3 GRID T201
PA GRID
PA PLATE
ANT TUNING
LOW PASS FILTER
PA LOADING
TUNE
XMIT
CENTRALIZED METERING JACK J201
MULT 3
MULT 4
PA GRID
GRD
PA PLATE
PA BIAS
PA +B
MULT 1
MULT 2
PTT
MIKE HI
MIKE LO
GRD
METER +10V
J202
+450 V
+300 V
GRD
-55 V
+12 V
FIL
FIL
J203
F1
F2
GRD
MIKE HI
MIKE LO
+10 V REG
PTT
SN22 BK
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER
THIS ELEM DIAG APPLIES TO
MODEL NO REV LETTER (SEE NOTE 4)
4EF32F10-B
4EF32F11-B
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS, INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY
(19D400823, Rev. 8)

SCHEMATIC DIAGRAM

132—174 MHZ TRANSMITTER
TYPES ET-74-A, B & E

RC-1414J

(Cont'd from front of RC-1413)

SYMBOL	GE PART NO.	DESCRIPTION
C203	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW: sim to RMC Type JF Discap.
C204 and C205	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C206 and C207	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C208*	74989x2P141	Silver mica: 390 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
		In Models earlier than REV A:
	74891x2P143	Silver mica: 470 pf ±10%, 300 VDCW: sim to Electro Motive Type DM-15.
C209	19B209328P5	Variable: air: approx 1.85 to 14.8 pf, 650 v peak: sim to EF Johnson 193-5-2.
C210	5496218P12	Ceramic disc: 18 pf ±10%, 500 VDCW, temp coef -470 PPM.
C211 and C212	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C213	19A118470P2	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW. sim to Erie 2432-019-X5R0-681K.
C214	19B209328P1	Variable, air: approx 5.1 to 50 pf, 1700 v peak; sim to Star Products Model APL.
C215	19B209328P10	Variable, air: approx 2.62 to 30.6 pf, 650 v peak; sim to EF Johnson 193-10-2.
C216	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C217	5496218P203	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C218 and C219	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW: sim to RMC Type JF Discap.
C220 and C221	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW: sim to RMC Type JF Discap.
C222 thru C224	7160807P1	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW.
C225	19B209328P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW, sim to Sprague Type 548C
C226 thru C229	7160807P1	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW.
C230		Includes:
	19A121018P1	Washer (inner). Quantity (4).
	403159P2	Insulator. Quantity (1).
	19A121006P1	Washer (outer). Quantity (2).
	403683SP4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N6GP9007C6	Screw, panhead, Phillips: No. 6-40 x 7/16.
C231	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW. sim to RMC Type JF Discap.
C232		Includes:
	19A121018P1	Washer (inner). Quantity (2).
	403159P2	Insulator. Quantity (1).
	7878455P2	Terminal, lug. Quantity (1).
	19A121006P7	Washer (outer). Quantity (2).
	403683SP4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N6GP9006C6	Screw, panhead, Phillips: No. 6-40 x 1/2.
C234		Includes:
	19A121018P1	Washer (inner). Quantity (4)
	403159P2	Insulator. Quantity (1).
	19A121006P1	Washer (outer). Quantity (2).
	403683SP4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N6GP9007C6	Screw, panhead, Phillips: No. 6-40 x 7/16.

SYMBOL	GE PART NO.	DESCRIPTION
C235	5496218P205	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C236	5496218P610	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef -470 PPM.
C237	5496218P205	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C238	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C239	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C240 and C241	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW, sim to Allen-Bradley Type FASC.
C242*	5496219P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM. Added by REV B.
		TERMINALS
E1	7135118P1	Solder
		JACKS AND RECEPTACLES
J201	19B205689G1	Connector: 18 contacts.
J202 and J203	19B205219P1	Connector: 7 pins.
J204	7104941P16	Jack, phono type: coaxial.
		RELAYS
K201	19C307020P5	Armature: 12 VDC nominal, 2.5 w max operating, 80 ohms ±15% coil res, 2 form C contacts.
		INDUCTORS
L204	7488079P34	Choke, RF: 1.5 µh ±10%, 0.28 ohm DC res max; sim to Jeffers 4412-7K.
L205	19A122079P1	Coil.
L206	7772834P5	Choke, RF: 1.8 µh ±10%, 0.33 ohm DC res; sim to Ohmite Z-144.
L207*	19B205220P1	Coil. Deleted by REV A in Models 4EF32F11.
L208*	19B205222P1	Coil.
L209*	7488079P35	Choke, RF: 2.2 µh ±10%, 0.5 ohm DC res max; sim to Jeffers 4412-9K.
L210	19A122072P1	Coil.
L211	19A122073P1	Coil.
L212	19A122072P1	Coil.
L213*	19B205220P2	Coil. Added by REV A.
		PLUGS
P201	4024X40P2	Contact, electrical: sim to AMP 42827-2.
P202	4029X40P1	Contact, electrical: sim to AMP 41854
P203		(Part of W202).
P204		(Part of W201).
		RESISTORS
R201	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R202	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R203	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R204	1R7xP273K	Composition: 27,000 ohms ±10%, 1 w.
R205	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R206	1R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R207	1R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R208	1R7xP183K	Composition: 18,000 ohms ±10%, 1 w.
R209	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R210	1R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R212	3R79P683K	Composition: 68,000 ohms ±10%, 2 w.
R213	3R149P822K	Composition: 8200 ohms ±10%, 4 w.
R214	19B209022P30	Wirewound: 4.3 ohms ±5%, 2 w; sim to IRC Type BWH
R215	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
		SWITCHES
S201	7145098P3	Slide: SPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole SS-32.
		TRANSFORMERS
T201		**COIL** 19B205215G1
		CAPACITORS
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
T202	5491798P4	Tuning slug.
		COIL 19B205213G1
		CAPACITORS
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5491238P10	Ceramic disc: 2 pf ±0.5 pf, 500 VDCW, temp coef -470 ±250 PPM.
		RESISTORS
R1	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
	5493185P5	Tuning slug.
		TERMINAL BOARDS
TB1	7775500P124	Phen 8 terminals.
		TUBES
V201 and V202		Type 6BQ6.
V203		Type 7984.
		CABLES
W201	5491689P5*	RF approx 12 inches, includes short, phono type plug (P301).
W202		**CABLE** 19B205268G1
		PLUGS
P105	19B209341P2	Socket: 9 contacts: sim to Elco 04-820-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head: No. 4, 1-2 inch long
		SOCKETS
XV201 and XV202	7480532P8	Tube, phen: 9 pins: sim to Elco 04-903-84.
XV203	19C301007P5	Tube: 12 pins; sim to Alcon Metal Products 371G.
		MECHANICAL PARTS (SEE RC-1396)
1	19A121195P2	Support. (Used with V203).
2	7165167P5	Insert, tube shield: sim to Atlas 106-332-5. (Used with V202).
3	19B205622P1	Spring. (Used with V201, 202)
4	19A121523P3	Heat sink. (Used with V201, 202).
5	7147223P4	Clip, loop: sim to Patton-Macguyer 40. (Used with W202).

SYMBOL	GE PART NO.	DESCRIPTION
6	19B205211P1	Support.
7	4035017P4	Support, angle: sim to Tinnerman C-19185-020-24.
8	7165167P7	Insert, tube shield: sim to Atlas 106-332-22. (Used with V203).
9	19B204571P1	Heat sink. (Used with V203).
10	19C303875G1	Chassis.
11	7763541P2	Strap, retaining.
12	19B205475G1	Cover, top.
13	19B205476G1	Cover, bottom.
14	19D402623P1	Casting.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

REV. A - To improve efficiency and bandwidth of final amplifier stage.

In Model 4EF32F10:
Changed C208.

In Model 4EF32F11:
Changed C208, deleted L207 and added L214.

REV. A - Models 4EF32F10, F11

To improve efficiency and bandwidth of final amplifier stage.

In Model 4EF32F10:
Changed C208.

In Model 4EF32F11:
Changed C208, deleted L207 and added L214.

REV. A - Models 4EG21F10, F11

To permit use of this exciter with High Band Royal Executive Systems. Changed L116 and added C142.

REV. B - Models 4EG21F10, F11

To permit use of this exciter with 25 kHz channel spacing.

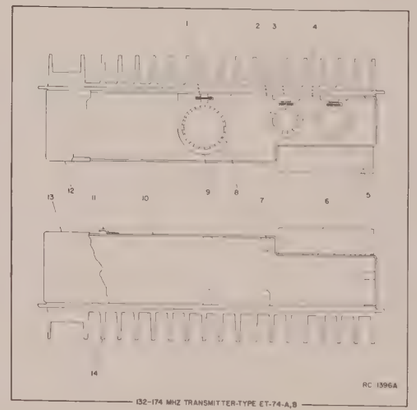
Changed R125: deleted R101, R114 & R115: and added R164, R165 & R166.

REV. B - Models 4EF32F10, F11

To reduce system losses in antenna circuit of receiver. Added C242, deleted G13.

REV. C - Models 4EG21F10, F11

To improve operation. Changed C122, C123, R130 and R134.



PARTS LIST

LBI-4257H

132-174 MHz RECEIVER
MODELS 4ER48C10-15

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C301	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C302	19A116656P5J8	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C303	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C304	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C305	5490008P131	Silver mica: 150 pf ±10%, 500 VDCW, sim to Electro Motive Type DM-15.
C306	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C307	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C308	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C309	7491827P102	Ceramic disc: .01 µf +80%-30%, 50 VDCW; sim to Sprague 19C180.
C310	19A116656P5J3	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -330 PPM.
C311	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C312	7491827P102	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C313	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C315	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C316	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C318	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C319A	5496219P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
C319B	5496219P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
C320A	5496219P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C320B	5496219P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C321A and C321B	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C322	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C323	19A116656P5J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C324	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C325	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C326A	5496219P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
C326B	5496219P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
C327A	5496219P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
C327B	5496219P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C328A and C328B	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.

SYMBOL	G-E PART NO	DESCRIPTION
C329	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C330	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C331A	5496219P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C331B*	5496219P740	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
		In REV A and earlier:
	5496219P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
C332A	5496219P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C332B*	5496219P740	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
		In REV A and earlier:
	5496219P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
C333	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C334	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C335	5496219P38	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C337	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C338A	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C338B	5496219P238	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C339	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C340	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C349	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C350	19A116149P3	Variable: 6 to 22 pf, 63 VDCW, temp coef -1500 PPM.
C351*	19C300685P248	Ceramic disc: 62 pf ±2%, 500 VDCW, temp coef -80 PPM.
		Earlier than REV A:
	5496219P259	Ceramic disc: 68 pf ±5%, 500 VDCW, temp coef -80 PPM.
C352	7491827P102	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C353	5496219P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C354	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie 557-36.
C355	5496219P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C356	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C357	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie 557-36.
C358	5496219P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C359	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C360	19A116659P1	Variable: approx 16-141 pf, 150 VDCW; sim to El Menco Type 42.
C361	5496219P54	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C362	5496219P13	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef 0 PPM.
C363	5490008P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C364	5490008P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C365	19A116080P6	Polyester: .068 µf ±20%, 50 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C366	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW, sim to Electro Motive Type DM-15.
C367	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C368	19A116080P6	Polyester: .068 µf ±20%, 50 VDCW.
C369	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C370	7491827P2	Ceramic disc: .01 µf +80%-30%, 50 VDCW; sim to Sprague 19C180.
C371A	5491601P116	Phenolic: 0.62 pf ±5%, 500 VDCW.
C371B	5491601P108	Phenolic: 0.30 pf ±5%, 500 VDCW.
C372	5496219P38	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C373	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C374	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C375	19A116655P13	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C376A	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C376B and C377A	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C377B	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C378	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C379	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C381	19A116656P160J1	Ceramic disc: 160 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C384	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C384*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C385	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C386*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C387	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C388*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C389	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C390*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C391	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C392*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.

(Cont'd on back of 19R621420)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

(19D416259, Rev. 7)
(19D413909, Sh. 1, Rev. 6)
(19D413909, Sh. 2, Rev. 6)

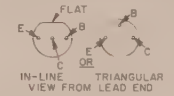
RESISTANCE READINGS

ALL READINGS ARE MEASURED FROM JACK PINS TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH ALL EXTERNAL CONNECTIONS REMOVED. + OR − SIGNS SHOW METER LEAD GROUNDED

PIN NUMBER	J302			J303			
	+	−	METER SCALE	+	METER SCALE	−	METER SCALE
1	INF	INF	X100Ω	300Ω	X Ω	725Ω	X Ω
2	INF	INF	X100Ω	7K Ω	X1Ω	K	Ω
3	INF	INF	X100Ω	3K Ω	X1Ω	INF	X100Ω
4	INF	INF	X100Ω	3.3K Ω	X1Ω	5K	Ω
5	0	0	X1Ω	0	X Ω	0	X Ω
6	INF	INF	X100Ω	INF	X100Ω	INF	X 100Ω
7	INF	INF	X100Ω	12K	X1Ω	6.5K	X Ω
8	INF	INF	X100Ω	INF	X 100Ω	INF	X 100Ω
9	INF	INF	X100Ω	0	X Ω	0	X Ω

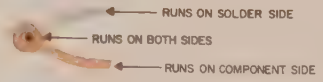
TERMINAL NUMBERING FOR J304

LEAD IDENTIFICATION FOR Q301, Q303, Q305, Q307, Q309, Q311 & Q321



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

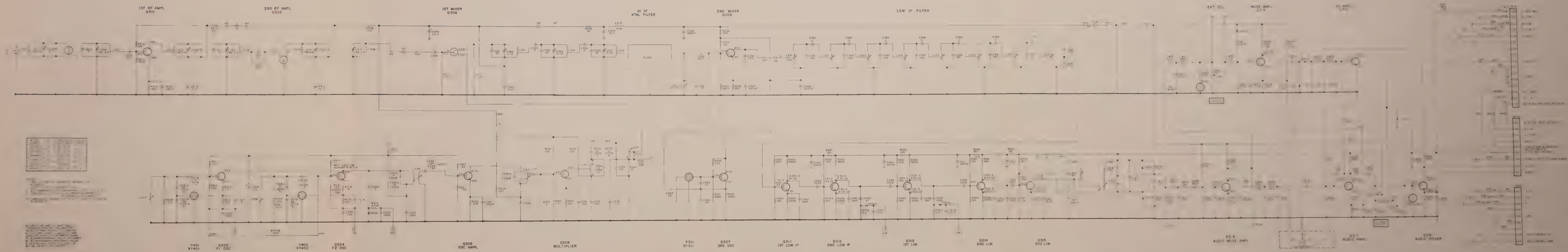
LEAD IDENTIFICATION FOR Q302, Q306



OUTLINE DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER48C10-15

RC-2163F



SCHEMATIC DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER48C10-15

19R621420, Rev. 19

SYMBOL	GE PART NO.	DESCRIPTION
C393	19A116656-P18G21	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM
C394*	5494219P43	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM. In KEY F and earlier:
	5494219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C395	5490068P34	Silver mica: 300 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C396	5494481P128	Ceramic disc: 4700 pf +80-20%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C398	19A116080P5	Polyester: .047 pf ±20%, 50 VDCW.
C399	5494481P112	Ceramic disc: 1000 pf +100-0%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C402	5490068P119	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C404	19A116080P5	Polyester: .047 pf ±20%, 50 VDCW.
C405	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C407	7491193P1	Ceramic disc: .001 pf +100-0%, 500 VDCW; sim to Sprague 131N-5.
C408	7491822P2	Ceramic disc: .01 pf +80%-20%, 50 VDCW; sim to Sprague 131N-6.
C409	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C411	19A116080P5	Polyester: .047 pf ±20%, 50 VDCW.
C412	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C413	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481P112	Ceramic disc: 1000 pf +100-0%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C416	19A116080P1802	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19A116080P5	Polyester: .047 pf ±20%, 50 VDCW.
C418 and C419	8490008P127	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496319P686	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481P113	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423	19A116080P109	Polyester: 0.22 pf ±10%, 50 VDCW.
C424	5494481P113	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425	19A116080P6	Polyester: .068 pf ±20%, 50 VDCW.
C426	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C427 and C428	19A116080P108	Polyester: 0.15 pf ±10%, 50 VDCW.
C429	19A116080P8	Polyester: 0.15 pf ±20%, 50 VDCW.
C430	5494481P113	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267P2	Tantalum: 47 pf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19A116080P8	Polyester: 0.15 pf ±20%, 50 VDCW.
C434	5494481P14	Ceramic disc: 3000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C435	19A116080P303	Polyester: .003 pf ±5%, 50 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C436	19C850075P47000J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C800075P33000J	Polyester: 3300 pf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C439*	3496267P17	Tantalum: 1.0 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
	3496267P1	Tantalum: 1.0 pf ±20% 6 VDCW; sim to Sprague Type 150D. In KEY H and J:
	3496267P2	Tantalum: 47 pf ±20% 6 VDCW; sim to Sprague Type 150D. In KEY G and earlier:
C440	19A116080P5	Polyester: .047 pf ±20%, 50 VDCW.
C441	19A116080P7	Polyester: 0.1 pf ±20%, 50 VDCW.
C442	19A116080P1	Polyester: .01 pf ±20%, 50 VDCW.
C460	3496267P9	Tantalum: 3.3 pf ±20%, 15 VDCW; sim to Sprague Type 150D.
C461	3496267P228	Tantalum: 0.47 pf ±10%, 35 VDCW; sim to Sprague Type 150D.
C462	3496267P14	Tantalum: 15 pf ±20%, 20 VDCW; sim to Sprague Type 150D.

- - - - - - DIODES AND RECTIFIERS - - - - - -

CR301*	19A116052P1	Silicon. In KEY B and earlier:
	7777146P5	Germanium; sim to Type 1N90.
CR302 and CR303	4038056P1	Germanium.
Q301*	19A116860P1	Silicon, NPN; sim to Type 2N4996. In KEY R:
	19A116859P1	Silicon, NPN; sim to Type 2N5032 or 2N3570. In KEY B, C, D:
	19A116566P1	Silicon, NPN. In KEY A and earlier:
Q302	19A116342P1	Silicon, NPN, N channel, field effect.
Q303 and Q304*	19A116328P1	Silicon, NPN. In KEY N and earlier:
Q305	19A116329P1	Silicon, NPN.
Q306*	19A116154P1	Silicon, NPN, N channel, field effect. In KEY A and earlier:
Q307	19A116329P1	Silicon, NPN.
Q308*	19A116810P1	Silicon, NPN; sim to Type 2N3906. In KEY E and earlier:
	19A115245P1	Silicon, NPN.
Q308A* and Q308B*	19A115440P1	Silicon, NPN. In KEY B, C, D:
	19A115668P1	Silicon, NPN. In KEY A and earlier:
	19A115343P1	Silicon.
Q311 thru Q315	19A115888P1	Silicon, NPN.
Q316	19A115123P1	Silicon, NPN.
Q317*	19A116774P1	Silicon, NPN; sim to Type 2N5210. In KEY C and earlier:
	19A115123P1	Silicon, NPN.
Q318*	19A115300P4	Silicon, NPN. In KEY C and earlier:
	19A115300P9	Silicon, NPN; sim to Type 2N3053.

SYMBOL	GE PART NO.	DESCRIPTION
L310	19B210057G1	Coil. Includes tuning slug 19B200497P2.
L311	19B210059G1	Coil. Includes tuning slug 19B200497P2.
L312 and L313	19B205224G2	Coil.
L314	19B205224G8	Coil.
L315	7488079P18	Choke, RF: 15 µh ±10%, 1.2 ohms DC res max; sim to Jeffers 4421-8K.
L317	19B210059G2	Coil. Includes tuning slug 19B200497P2.
L321 and L322	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12870.
L323	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12871.
L324	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12870.
L325	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12871.
L326	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12870.
L327	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12871.
L328	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12870.
L329	19A115711P6	Transformer, freq: 455 KHz; sim to TOKO PEICH-14733-CX12.
L330	19A115711P7	Transformer, freq: 455 KHz; sim to TOKO PEICH-14734-EH12.
L331	19B209403P1	Reactor, audio freq: 142 mh ±5% at 0.1 v thru 0.37 v; sim to Aladdin 405-101.

- - - - - - - - TRANSISTORS - - - - - - - -

Q301*	19A116860P1	Silicon, NPN; sim to Type 2N4996. In KEY R:
	19A116859P1	Silicon, NPN; sim to Type 2N5032 or 2N3570. In KEY B, C, D:
	19A116566P1	Silicon, NPN. In KEY A and earlier:
Q302	19A115342P1	Silicon, NPN, N channel, field effect.
Q303 and Q304*	19A115328P1	Silicon, NPN. In KEY N and earlier:
Q305	19A115329P1	Silicon, NPN.
Q306*	19A115154P1	Silicon, NPN, N channel, field effect. In KEY A and earlier:
Q307	19A115329P1	Silicon, NPN.
Q308*	19A115810P1	Silicon, NPN; sim to Type 2N3906. In KEY E and earlier:
	19A115245P1	Silicon, NPN.
Q308A* and Q308B*	19A115440P1	Silicon, NPN. In KEY B, C, D:
	19A115668P1	Silicon, NPN. In KEY A and earlier:
	19A115343P1	Silicon.
Q311 thru Q315	19A115888P1	Silicon, NPN.
R341	3B77P1003E	Composition: 10,000 ohms ±10%, 1/2 w.
R342	3B77P101E	Composition: 100 ohms ±10%, 1/2 w.
R343	3B77P331E	Composition: 330 ohms ±10%, 1/2 w.
R344	3B77P303J	Composition: 3000 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
Q319*	19A116774P1	Silicon, NPN; sim to Type 2N5210. In KEY G and earlier:
	19A115888P1	Silicon, NPN.
Q320*	19A116774P1	Silicon, NPN; sim to Type 2N5210. In KEY E and earlier:
	19A115123P1	Silicon, NPN.

- - - - - - - - - RESISTORS - - - - - - - - -

R301	3B77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R302	3B77P223E	Composition: 22,000 ohms ±10%, 1/3 w.
R303	3B77P561K	Composition: 560 ohms ±10%, 1/2 w.
R304	3B77P331K	Composition: 330 ohms ±10%, 1/2 w.
R305	3B77P101K	Composition: 100 ohms ±10%, 1/2 w.
R306 and R310	3B77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R311	3B77P683J	Composition: 68000 ohms ±5%, 1/2 w.
R312	3B77P150K	Composition: 15 ohms ±10%, 1/2 w.
R313*	3B77P391K	Composition: 390 ohms ±10%, 1/2 w. In KEY N and earlier:
	3B77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R314	3B77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R315 and R316	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R317	3B77P683J	Composition: 68000 ohms ±5%, 1/2 w.
R318	3B77P150K	Composition: 15 ohms ±10%, 1/2 w.
R319*	3B77P391K	Composition: 390 ohms ±10%, 1/2 w. In KEY N and earlier:
	3B77P103K	Composition: 1000 ohms ±10%, 1/2 w.
R320	3B77P221K	Composition: 220 ohms ±10%, 1/2 w.
R321*	3B77P273E	Composition: 2700 ohms ±10%, 1/2 w. In KEY A and earlier:
	3B152P392E	Composition: 3900 ohms ±10%, 1/4 w.
R322	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R323	3B77P431J	Composition: 430 ohms ±5%, 1/2 w.
R324	3B77P101K	Composition: 100 ohms ±10%, 1/2 w.
R326	3B77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R327	3B77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R329	3B152P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R331	3B77P683E	Composition: 6800 ohms ±10%, 1/2 w.
R332	3B77P392E	Composition: 3900 ohms ±10%, 1/2 w.
R333	3B77P682E	Composition: 6800 ohms ±10%, 1/2 w.
R334	3B77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R335	3B77P561K	Composition: 560 ohms ±10%, 1/2 w.
R336	3B77P331K	Composition: 330 ohms ±10%, 1/2 w.
R337	3B152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R338	3B152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R339	3B77P101K	Composition: 100 ohms ±10%, 1/2 w.
R340*	3B77P273E	Composition: 2700 ohms ±10%, 1/2 w. In KEY A and earlier:
	3B152P392E	Composition: 3900 ohms ±10%, 1/4 w.
R341	3B77P103E	Composition: 10,000 ohms ±10%, 1/2 w.
R342	3B77P101E	Composition: 100 ohms ±10%, 1/2 w.
R343	3B77P331K	Composition: 330 ohms ±10%, 1/2 w.
R344	3B77P303J	Composition: 3000 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R395	3B77P331K	Composition: 330 ohms ±10%, 1/2 w.
R396 thru R397	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
	19A115889P1	Silicon, NPN.
R399*	3B77P333J	Composition: 33000 ohms ±5%, 1/2 w. In KEY M and earlier:
	3B77P471J	Composition: 470 ohms ±5%, 1/2 w.
R400		(See R392).
R401	19A116278P357	Metal film: 78,300 ohms ±2%, 1/2 w
R402	19A116278P313	Metal film: 13,300 ohms ±2%, 1/2 w.
R403	3B152P333J	Composition: 3300 ohms ±5%, 1/4 w.
R404	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R405	3B152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406*	3B152P223J	Composition: 22000 ohms ±5%, 1/4 w. In KEY L:
	3B152P566J	Composition: 5600 ohms ±5%, 1/4 w. In KEY M-K:
	3B152P333K	Composition: 3300 ohms ±10%, 1/4 w. In KEY C-G:
	3B152P103J	Composition: 10,000 ohms ±5%, 1/4 w. In KEY B and earlier:
	3B152P333J	Composition: 3300 ohms ±5%, 1/4 w.
R407	3B77P222E	Composition: 2200 ohms ±10%, 1/2 w.
R408	3B77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R409*	3B77P303J	Composition: 30,000 ohms ±5%, 1/2 w. In KEY M and J:
	3B77P103J	Composition: 10,000 ohms ±5%, 1/2 w. In KEY G and earlier:
	3B77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R410*	3B77P103J	Composition: 1 megohm ±5%, 1/2 w. Added by REV S.
R412	3B77P561K	Composition: 560 ohms ±10%, 1/2 w.
R417	3B152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R419*	3B77P273K	Composition: 27,000 ohms ±10%, 1/2 w. In KEY L and earlier:
	3B77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R420*	3B77P564J	Composition: 0.56 megohm ±5%, 1/2 w, Deleted by REV L. In KEY J and earlier:
	3B77P564J	Composition: 0.56 megohm ±5%, 1/2 w.
R431	3B77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R442*	3B152P331K	Composition: 330 ohms ±10%, 1/4 w. Added by REV E.

- - - - - - - - THERMISTORS - - - - - - - -

RT301	5490828P38	Rod: 1400 ohms ±5%, 1 w max; sim to Globar Type 493E.
RT302	5490828P35	Rod: 2800 ohms ±5%, 1 w max; sim to Globar Type 723B-H.

- - - - - - - - - SOCKETS - - - - - - - - -

XY401 and XY402	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.

- - - - - - - - CRYSTALS - - - - - - - - -

Y301	19A110215G1	Quartz: freq 10245 KHz, temp range -30°C to +90°C.
Y401 and Y402	19B206221P1	Quartz: freq range 38.3 to 62 MHz, temp range -30°C to +80°C. (When ordering give GE Part Number and specify exact frequency needed). Crystal frequency - Operating freq -10.7

- - - - - - - - MISCELLANEOUS - - - - - - - -

	19A122139P1	Cover.
	19B205369G1	Top cover.
	19A121048P1	Can. (Used with L307 and L308).
	4035306P62	Washer, fiber. (Used with Y301, FL301).
	4036555P1	Insulator, washer: nylon. (Used with Q318).

SYMBOL	GE PART NO.	DESCRIPTION
R345	3B152P622E	Composition: 62,000 ohms ±10%, 1/4 w.
R350	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R351	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R352	3B77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R353	3B77P563E	Composition: 56000 ohms ±10%, 1/2 w.
R354	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R355	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R356	3B152P222K	Composition: 2200 ohms ±10%, 1/4 w. Changed R301 and R306.
R357	3B77P181K	Composition: 180 ohms ±10%, 1/2 w.
R358	3B77P913J	Composition: 91,000 ohms ±5%, 1/2 w.
R359	3B77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R360	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R361	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R362	3B77P181K	Composition: 180 ohms ±10%, 1/2 w.
R363	3B77P222E	Composition: 2200 ohms ±10%, 1/2 w.
R364	3B77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R365	3B77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R366	3B77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R367	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R368	3B152P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3B77P951J	Composition: 5100 ohms ±5%, 1/2 w.
R370	3B77P181K	Composition: 180 ohms ±10%, 1/2 w.
R371	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R372	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R373	3B77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R374	3B77P181K	Composition: 180 ohms ±10%, 1/2 w.
R375 and R376	3B77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R377	3B77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R378	3B152P104K	Composition: 0.1 megohm ±10%, 1/4 w.
R379	3B77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R380	3B77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R381	3B77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R382	3B152P221J	Composition: 220 ohms ±5%, 1/4 w.
R383	3B77P332E	Composition: 3300 ohms ±10%, 1/2 w.
R384	3B152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3B152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386*	3B77P163J	Composition: 16,000 ohms ±5%, 1/2 w. In KEY C and earlier:
	3B77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R388	3B77P300J	Composition: 30 ohms ±5%, 1/2 w.
R389*	3B77P103K	Composition: 1000 ohms ±10%, 1/2 w. In KEY L and earlier:
	3B77P681J	Composition: 680 ohms ±5%, 1/2 w.
R390	3B77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R391	3B77P431K	Composition: 430 ohms ±10%, 1/2 w.
R392(R400)	19B209320P1	Resistor assembly. Variable, carbon film, includes: (R392) 20,000 ohms ±20%, 0.25 w; (R400) 5000 ohms ±20%, 0.25 w; sim to Centralab Series 9 (Type 71-S).
R393*	3B77P203J	Composition: 2000 ohms ±5%, 1/2 w. In KEY G and earlier:
	3B77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R394	3B77P103J	Composition: 10,000 ohms ±5%, 1/2 w.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Models EM48C10-15

REV. B - Incorporated into initial shipment.

REV. C - To improve squelch action. Changed R406.

REV. D - To improve audio at -30°C. Changed Q317, Q318 and R386.

REV. E - To prevent oscillation. Changed Q308 and Q308. Added R442.

REV. F - To incorporate new transistors. Changed Q301 and Q306.

REV. G - To improve squelch clipping performance. Changed C382, C384, C386, C388, C390, C392, and C394.

REV. H - To improve audio response and squelch action. Changed R387, R406, R409, R439 and Q319.

REV. J - To increase "S" reading on Test Set. Changed CR301.

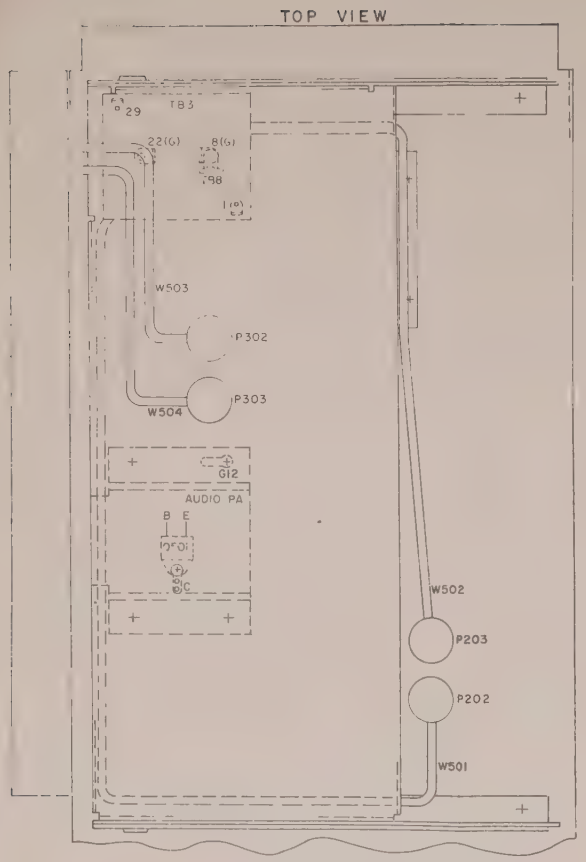
REV. K - To improve squelch action. Changed R406 and Q320.

REV. L - To improve squelch action. Changed R406 and Q320. Deleted R420.

REV. M - To improve audio response. Changed R389, R419, R406 and added R410 and CR310.

REV. N - To improve squelch operation. Changed R399.

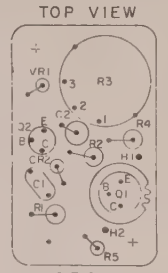
REV. P - To eliminate residual Position D reading on GE Test Set with 1st oscillator crystal removed. Changed R313, R319, Q303 and Q304.



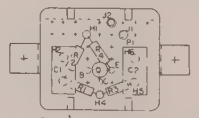
RESISTANCE READINGS

RESISTANCE READINGS ARE MEASURED FROM TB3 TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH ALL EXTERNAL CONNECTIONS REMOVED — OR + SIGN SHOWS METER LEAD GROUNDED

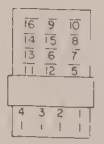
MEASURED FROM	−	+
TB3-21	∞	∞
TB3-26	∞	∞
TB3-25	36Ω	30K
TB3-14	20Ω	250K
J501-5	∞	∞
T501-3	∞	∞
TB3-16	6.4K	225K
TB3-17	5.6K	50K
TB3-20	21K	90K
TB3-27	0	0



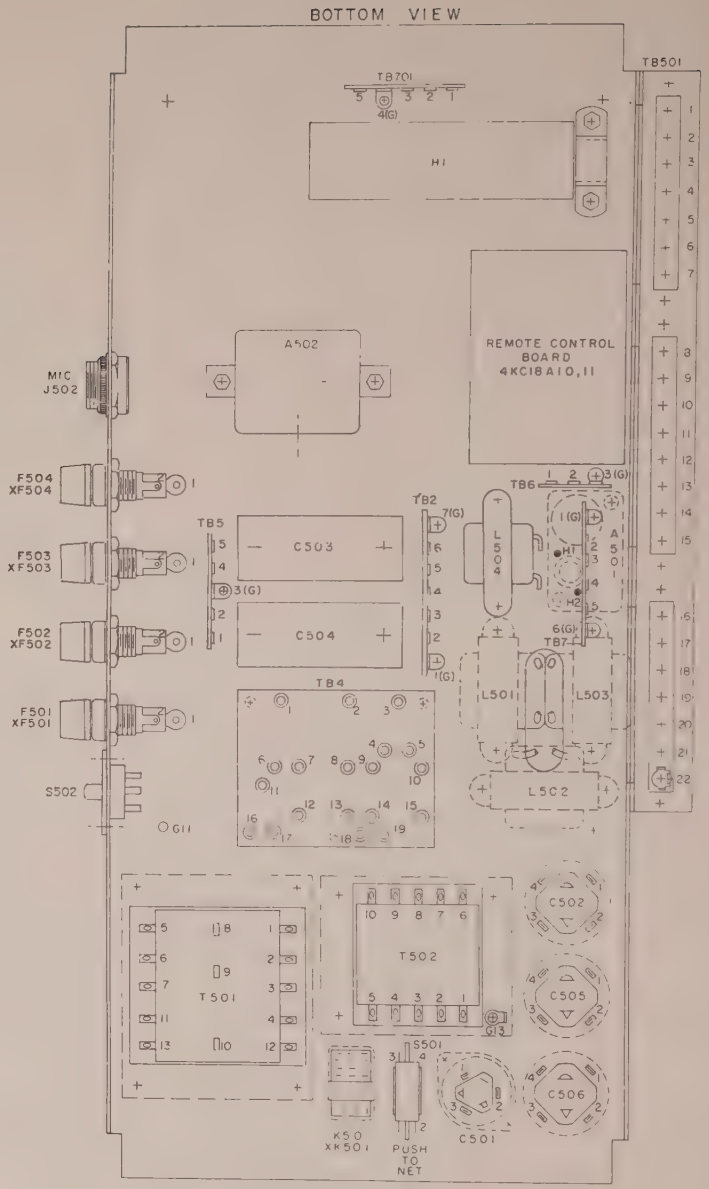
A501
10-VOLT REGULATOR



BOTTOM VIEW OF A502

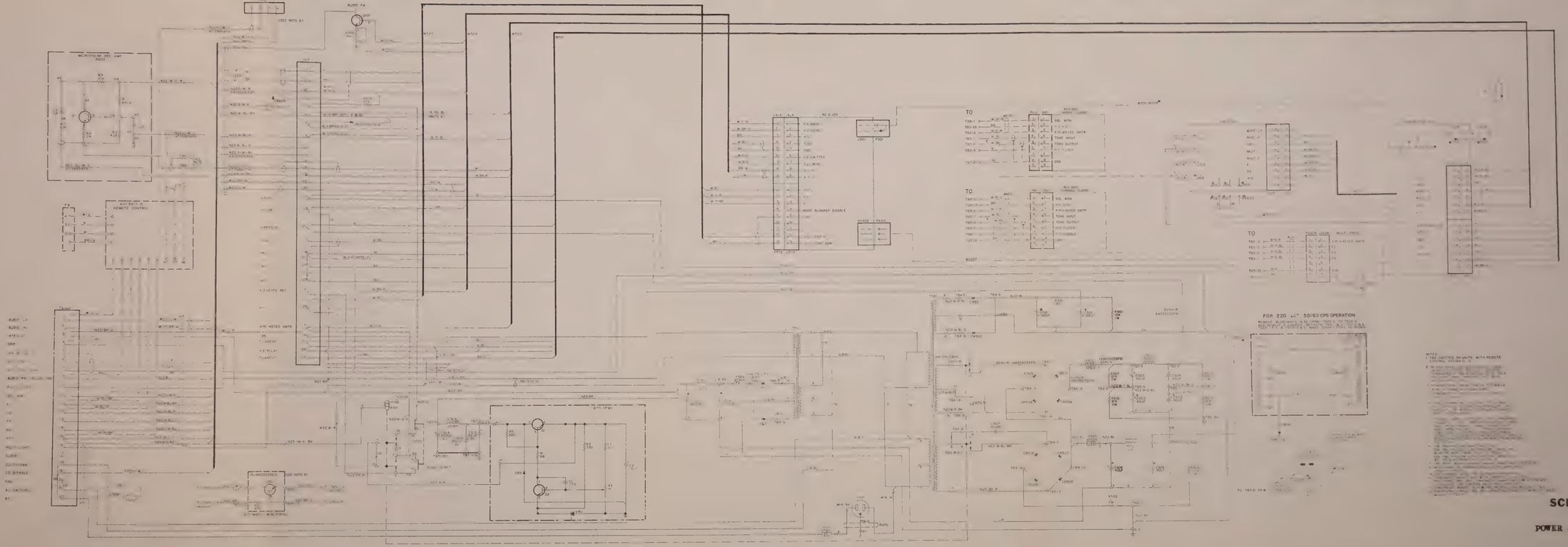


TERMINAL VIEW OF K501



OUTLINE DIAGRAM

POWER SUPPLY MODEL 4EP51A10
(19D402812, Rev. 10)



SCHEMATIC DIAGRAM

POWER SUPPLY MODEL 4EP51A10

(19R640706, Rev. 28)

PARTS LIST

LSI-37208

STATION POWER SUPPLY
MODEL 4EPS1A10

SYMBOL	GE PART NO.	DESCRIPTION
A501		**10 VOLT REGULATOR** 19B205255G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5494461P107	Ceramic disc: 470 pf ±20%, 1000 VDCW: sim to RMC Type JF Discap.
C2	5494267P14	Tantalum: 15 µf ±20%, 20 VDCW. sim to Sprague Type 150D.
C3* and C4*	5494267P2	Tantalum: 47 µf ±20%, 6 VDCW: sim to Sprague Type 150D. Deleted by REV K.
		- - - - - - - DIODES & RECTIFIERS - - - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - INDICATING DEVICES - - - - - - -
DS1*	4034864P1	Lamp, incandescent: 28 v; sim to GE 2148. Deleted by REV K.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q2*	19A116755P1	Silicon, NPN; sim to Type 2N3947. Is REV L and earlier
	19A115123P1	Silicon, NPN. sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1*	3R77P680K	Composition: 68 ohms ±10%, 1 2 w. Is Models earlier than REV B:
	3R77P161J	Composition: 160 ohms ±5%, 1/2 w.
R2	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R3	19A115681P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 11S.
R4	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R5*	3R153P221K	Composition: 220 ohms ±10%, 1/4 w. Added by REV E.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P6	Silicon, Zener.
A502*		**MICROPHONE PRE-AMPLIFIER** 19B204663G2 Added by REV C
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	19A115028P114	Polyester 0.1 µf ±20% 200 VDCW.
		- - - - - - - JACKS & RECEPTACLES - - - - - - -
J1 and J2	4033513P4	Contact, electrical: sim to Bead Chain L83-3.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	4029840P2	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115889P1	Silicon, NPN; sim to Type 2N2712.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P434J	Composition: 0.43 megohm ±5%, 1/2 w.
R2	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R3	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R4	3R77P203J	Composition: 2000 ohms ±5%, 1/2 w.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501	5496456P4	Electrolytic, twist-prong: 100-100 µf +100% -10%, 150-150 VDCW; sim to GE 43F.
C502	7770994P25	Electrolytic, twist-prong: 40-40 µf +50% -10%, 450-450 VDCW; sim to Mallory Type FP.
C503 and C504	7774786P45	Electrolytic: 40 µf +50% -10%, 450 VDCW; sim to PR Mallory TC7S.
C505	7770994P25	Electrolytic, twist-prong: 40-40 µf +50% -10%, 450-450 VDCW; sim to Mallory Type FP.
C506	7478442P21	Electrolytic, twist-prong: 1000-1000 µf +250% -10%, 25-25 VDCW, sim to GE 43F.
C507	5494481P21	Ceramic disc: 10,000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C508 thru C510	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
C511*	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D. Deleted by REV G.
		- - - - - - - DIODES & RECTIFIERS - - - - - -
CR501 and CR502	4037822P1	Silicon.
CR503 thru CR510	4037822P2	Silicon. Is REV L and earlier
CR511 and CR512	4037822P1	Silicon.
		- - - - - - - - - - FUSES - - - - - - - - - -
F501	1B16P6	Quick blowing: 3 amps at 250 v; sim to Littelfuse 313003 or Bussman AGC-3.
F502	7487943P2	Slow blowing: 3/8 amp at 250 v; sim to Bussman MDL-3/8.
F503	7487942P1	Slow blowing: 1/4 amp at 250 v; sim to Bussman MDL-1/4.
F504	7487942P27	Slow blowing: 2 amps at 125 v; sim to Bussman MDL-2.
J503		**- - - - - JACKS AND RECEPTACLES - - - - -** Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-P947-1000.
	19A116081P4	Lockwasher.
	19A122860P1	Nut, knurled.
K501	19C307010P6	**- - - - - - - - RELAYS - - - - - - - - -** Armature: 12 VDC nominal, 1.5 w max operating, 130 ohms ±10% coil res. 4 form C contacts; sim to Allied Contro. 7154-X-413.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L501	19B209346P1	Reactor: 0.6 h min, 40 ohms max DC res, 600 VDC operating.
L502	19B209347P1	Reactor: 1.2 h min, 50 ohms max DC res, 300 VDC operating.
L503	19B209345P1	Reactor: .02 h min, 0.5 ohms max DC res, 18 VDC operating.
L504	5490036P1	Reactor: .02 h min, 1.3 ohms ±10% DC res, 1.5 VDC operating.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501		(Part of W505).

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q501*	19A116203P3	Silicon, NPN.
		Earlier than REV G.
	19A115527P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R501	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R502	3R78P103K	Composition: 10,000 ohms ±10%, 1 w.
R503	19A116310P23	Composition: 10 ohms ±5%, 2 w; sim to Allen-Bradley Type HB.
R504 and R505	3R78P913J	Composition: 91,000 ohms ±5%, 2 w.
R506	3R79P104K	Composition: 0.1 megohm ±10%, 2 w.
R507	3R78P913J	Composition: 91,000 ohms ±5%, 2 w.
R508	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R509	19B209022P109	Wirewound: 0.56 ohm ±10%, 2 w; sim to IRC Type BWH.
R510	3R79P913J	Composition: 91,000 ohms ±5%, 2 w.
		- - - - - - - - - SWITCHES - - - - - - - - -
S501	4038038P1	Pushbutton, red: SPDT, 1 amp at 125 VAC; sim to Arrow-Hart and Hegeman 3382-A.
S502*	7145098P1	Slide: DPDT, 0.75 amp at 125 VAC, or 0.5 amp at 125 VDC; sim to Stackpole SS-150. Added by REV E.
		- - - - - - - TRANSFORMERS - - - - - - -
T501	19A115698P1	Power: 117/220 VAC.
T502	19A115699P1	Power.
		- - - - - - - TERMINAL BOARDS - - - - - - -
TB2	7775500P17	Phen: 7 terminals.
TB3	19B205258G1	Board: 27 terminals.
TB4	19A122174G1	Composent board: 19 eyelets.
TB5	7775500P11	Phen: 5 terminals.
TB6	7775500P2	Phen: 3 terminals.
TB7	7775500P16	Phen: 6 terminals.
TB8*	7487424P23	Miniature, phen: 1 terminal. Added by REV A.
TB501		Board. Includes the following:
	7117710P7	Phen: 7 terminals; sim to Cinch 177D. (Quantity 2).
	7117710P8	Phen: 8 terminals; sim to Cinch 178D.
		- - - - - - - - - CABLES - - - - - - - - -
W501		**CABLE** 19B205266G2 (Used in Transmitter)
		- - - - - - - - - PLUGS - - - - - - - - -
P202	19B209341P1	Socket: 7 contacts; sim to Elco 04-720-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head.
W502		**CABLE** 19B205267G1 (Used in Transmitter)
		- - - - - - - - - PLUGS - - - - - - - - -
P203	19B209341P1	Socket: 7 contacts; sim to Elco 04-720-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head.

SYMBOL	GE PART NO.	DESCRIPTION
W503		**CABLE** 19B205265G1 (Used in Receiver)
		- - - - - - - - - PLUGS - - - - - - - - -
P302	19B209341P2	Socket: 9 contacts; sim to Elco 04-920-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head.
W504		**CABLE** 19B205264G2 (Used in Receiver)
		- - - - - - - - - PLUGS - - - - - - - - -
P303	19B209341P2	Socket: 9 contacts; sim to Elco 04-920-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head.
W505	19A122527G2	Cable: includes 3-pin socket (P501).
		- - - - - - - - - SOCKETS - - - - - - - - -
XF501 thru XF504	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
XK501	5491595P6	Relay: 16 contacts; sim to Allied Control 30054-2.
		HARNESS ASSEMBLY 19D402655G2 (Includes A502, TB3, W501-W504)
		ASSOCIATED ASSEMBLIES
		POWER CABLE 19A122527G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5490056P1	Cable, power: approx 36 inches, includes 3-pin socket.
	19B209260P2	Solderless terminal.
		ANTENNA CABLE 19A122133G3
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4029483P1	Receptacle, panel: coaxial; sim to Amphenol 83-798 or Equiv. Military 80-239A.
	5491689P68	Cable, RF: approx 48 inches, includes phono-type plug.
	4029082P1	Adapter.
		MONITOR KIT (CHANNEL GUARD) 19A122220G15
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q701	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - RESISTORS - - - - - - - - -
R701	3R77P474K	Composition: 0.47 megohm ±10%, 1/2 w.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB701	7775500P9	Phen: 5 terminals.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4033439P1	Heat sink, transistor: sim to Birtcher 3AL-635-2R. (Used with Q1 in A501).
	4036555P1	Insulator, washer: nylon. (Used with Q1 in A501).
	4038574P11	Stand-off. (Mounts TB4).
	7121396P4	Retainer, capacitor: phen. (Used with C501).
	5491595P9	Retainer, spring. (Used with K501).
	4031594P2	Insulator. (Located under R3).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Model 4EPS1A10

To permit the addition of a Channel Guard disable switch, added TB8, deleted jumper from TB501-18 to TB501-19, and added G-B-O wire from TB501-19 to TB8-1.

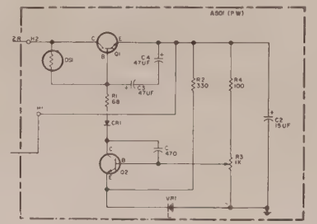
REV. B - To improve operation of 10-volt regulator A501. Changed R1.

REV. C - To amplify the microphone output. Added pre-amplifier A502.

REV. D - To prevent high frequency oscillations in audio PA when a high gain transistor is used. Added C511.

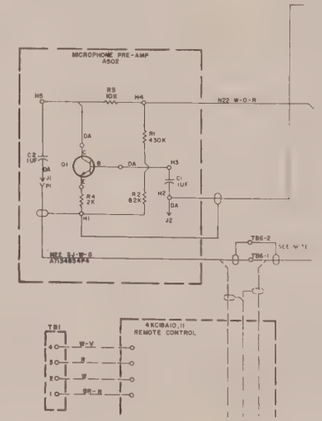
REV. E - To provide a station power ON-OFF switch on the rear of the power supply chassis. Added S502.

REV. F - To protect 10-Volt Regulator A501 against reverse polarity. Deleted CR1 and added CR2.
Schematic Diagram Was:



REV. G - To incorporate a new audio output transistor. Deleted C551, and changed Q501.

REV. H - To increase the line level sensitivity for use with remote line levels as low as -20 dBm. Re-routed wiring of Mic Preamp. A502.
Schematic Diagram was:



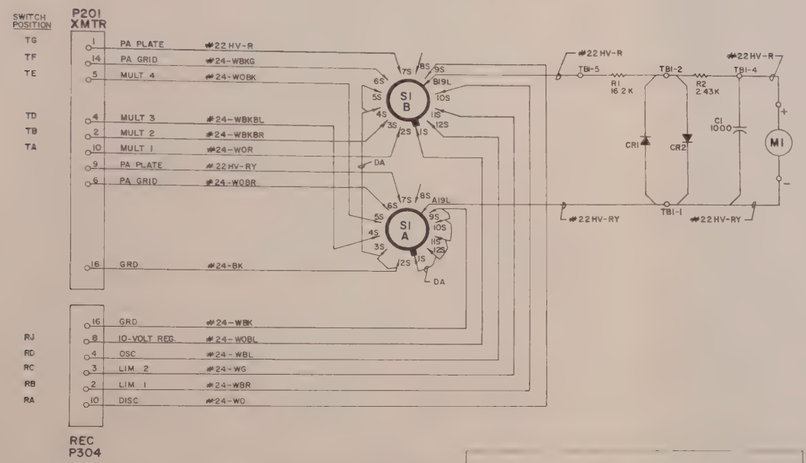
REV. J - To eliminate keying thump in receiver. Moved white-brown-red wire from TB3-14 to TB3-23.

REV. K - To improve reliability of 10V regulator. Deleted DS1 and added R5.

REV. L - To improve operation of 10-Volt regulator A501. Deleted C3 and C4.

REV. M - To incorporate improved transistor. Replaced Q2.

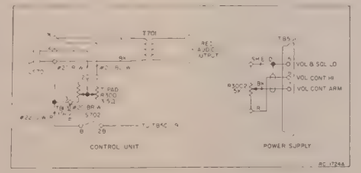
TEST METER OPTION



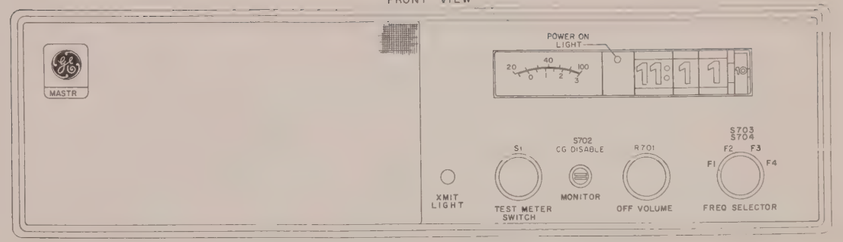
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

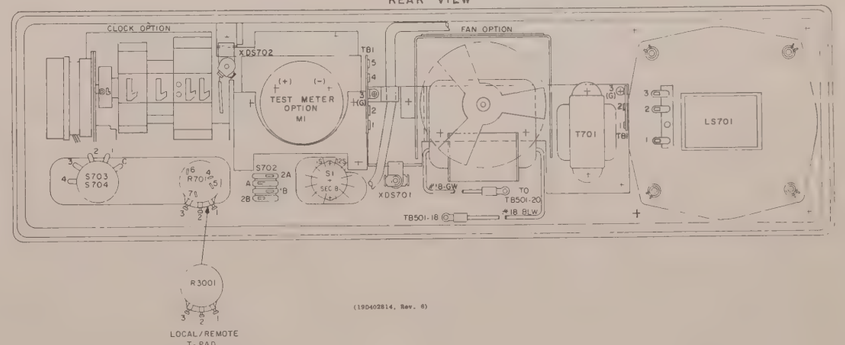
(19C311061, Rev. 2)



FRONT VIEW



REAR VIEW



(19D402814, Rev. 6)

NOTES

1. S703 IN 4EC69A11 ONLY
   TWO FREQ. KIT PL19A122220G8.
   S704 IN 4EC69A12 ONLY
   FOUR FREQ KIT PL19A122220G9.
2. TERMINATE WIRES TO TERMINALS 1 THRU 3, 5 THRU 10, 15, 16 & 19 WITH 19B209260P103.
3. BLOWER KIT PL19A122295G1
4. CLOCK KIT PL19A122222G1, G2

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

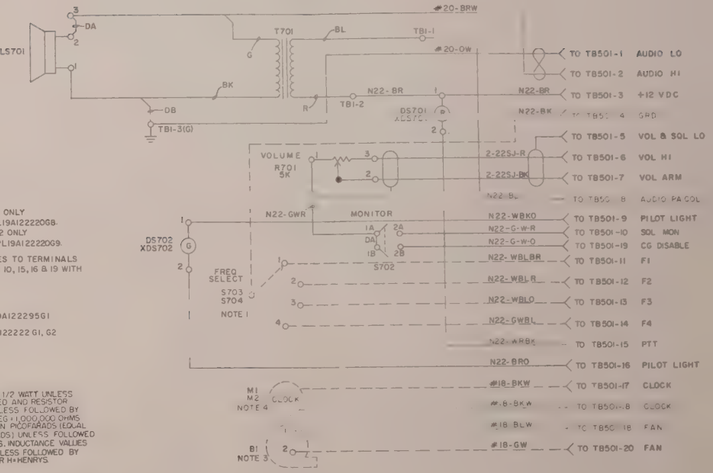
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EC69A10	B
4EC69A11	B
4EC69A12	B

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19C303970, Rev. 6)

CONTROL UNIT SCHEMATIC



(DF-4076)

SCHEMATIC & OUTLINE DIAGRAM

DESK TOP CONTROL UNIT MODEL 4EC69A10-12

RC-1421H

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PARTS LIST

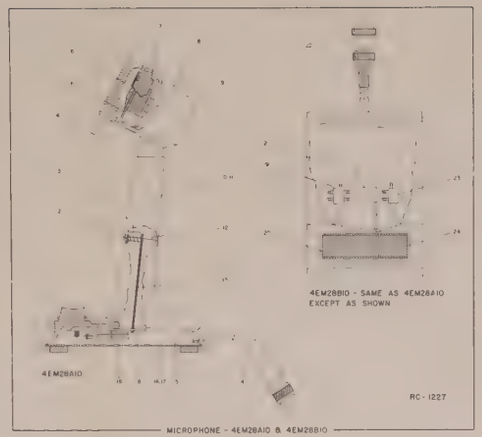
LBI-3722D

DESK STATION CONTROL UNIT
MODEL 4EC69A10 (19D402659G1) (1 Frequency)
MODEL 4EC69A11 (19D402659G1) (2 Frequency)
(19A122220G6)
MODEL 4EC69A12 (19D402659G1) (4 Frequency)
(19A122220G9)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS701 and DS702	19C307037P19	Lamp, incandescent: 14 v; sim to GE 756.
		- - - - - - - - LOUDSPEAKERS - - - - - - -
LS701	19B209101P1	Permanent magnet, 5-inch: 2-1/4 w voice input operating; sim to Cletron X10271.
		- - - - - - - - - - RESISTORS - - - - - - - -
R701*	5496870P23	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(5K).
		In Models earlier than REV B:
	5496870P13	Resistor/switch: includes Resistor, variable, carbon film, 5000 ohms ±20%, 0.5 w; Switch (S701), rotary, DPST, 6 amps at 125 VAC; sim to Mallory LC(5K)OAC-2.
		- - - - - - - - SWITCHES - - - - - - - -
S701*		(Part of R701). Deleted by REV B.
S702*	19B209139P6	Lever: 3 amps at 120 VAC, 1 form A contact locking, 1 form A contact momentary; sim to Switchcraft Series 205-1023.
		In Models earlier than REV A:
	19B209139P3	Lever: 3 amps at 120 VAC, 1 form A contact momentary; sim to Switchcraft Series 28201.
		- - - - - - - - TRANSFORMERS - - - - - - -
T701	19A115612P1	Audio freq: 0.3-3 KHz freq range, Pri: 24.5 ohms ±5% imp, 1.38 ohms DC res, Sec: 3.3 ohms imp, 0.18 ohm DC res.
		- - - - - - - - TERMINAL BOARDS - - - - - -
TB1	7775500P2	Phen: 3 terminals.
		- - - - SOCKETS - - - -
XDS701, XDS702	19B209342P1	Lampholder: sim to Leecraft 7-04.
		- - - - MISCELLANEOUS - - - -
	19B205292P1	Window, clear. (Used in front of clock and meter).
	19A115679P1	Knob, push-on: black. (Used with R701).
	19B209949P1	Jewel: red. (Used with DS701).
		MODIFICATION KIT 19A122220G8 (MODEL 4EC69A11) (2 Freq) 19A122220G9 (MODEL 4EC69A12) (4 Freq)
		- - - - - - - - - - SWITCHES - - - - - - - -
S703	19B204441G3	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VAC; sim to Grayhill Series 24 (modified).
		ASSOCIATED ASSEMBLIES
		12 24 HOUR CLOCK 19A122222G2
		METERS
M1	19B205374G1	Clock, direct reading: 110 VAC, 60 Hz; sim to Pennwood Numechron 1P-12H.

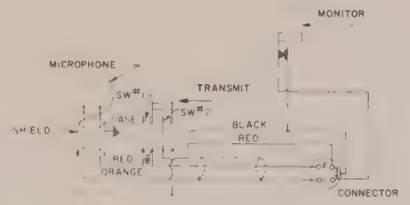
SYMBOL	GE PART NO.	DESCRIPTION
		12 HOUR CLOCK 19A122222G1
		- - - - - - - - - METERS - - - - - - - - -
M2	19B205374G4	Clock, direct reading: 110 VAC, 60 Hz; sim to Pennwood Numechron 1P-24H-AM/PM.
		METER KIT 19A122134G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	5494922P1	Silicon; sim to Type 1N456.
		- - - - - - - - - METERS - - - - - - - - -
M1	19A115716P1	Panel, DC: -10/0/+50 µa mechanism.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	5495948P321	Deposited carbon: 16,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R2	5495948P238	Deposited carbon: 2430 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
		- - - - - - - - TERMINAL BOARDS - - - - - -
TB1	7775500P11	Phen: 5 terminals.
		- - - - - - - - - CABLES - - - - - - - - -
W1		CABLE 19C311056G1
		- - - - - - - - - PLUGS - - - - - - - - -
P201	19A122278G1	Connector: 13 terminals.
P304	19A122278G1	Connector: 13 terminals.
		- - - - - - - - - SWITCHES - - - - - - - - -
S1	5495454P24	Rotary: 2 sections, 2 poles, 12 positions, non-shorting contacts, 2 amps at 25 VDC or 1 amp at 110 VAC; sim to Oak Type A or Centralab Series 100.
		FAN KIT 19A122295G1
		- - - - - - - - - MOTORS - - - - - - - - - -
B1	19B205346G1	AC: 115 VRMS at 60 Hz continuous, .0017 hp, 2400 rpm max, cw rotation.
	19B209068P1	Impeller, fan: axial, cw rotation. (Part of B1).
		LOCAL REMOTE MODIFICATION KIT 19A127258G1
		- - - - - - - - RESISTORS - - - - - - - -
R304	19B209423P1	Variable, audio, L-pad: 3.5 ohms ±15%, 2.5 w; sim to CTS Type AW.
R304	5496870P22	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(5K).
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	7165075P2	Hex nut, brass: No. 3/8-32.
	7115130P9	Lockwasher: sim to Shakeproof 1220-2.
		MASK PLATE 19B205401G2 CLOCK AND METER 19B205401G3 12/24 HOUR CLOCK 19B205401G4 METER
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19A122210P1	Lens: green.
	19A205291P1	Plate. (Used in 19B205401G2).
	19A205291P2	Plate. (Used in 19B205401G3).
	19A205291P3	Plate. (Used in 19B205401G4).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



MICROPHONE - 4EM28A10 & 4EM28B10

CIRCUIT DIAGRAM
4EM28A10



CIRCUIT DIAGRAM
4EM28B10

* JUMPER MAY BE REMOVED FOR PARALLEL OR SPECIAL OPERATION

NOTES

1. SWITCH #1 OF THE MICROPHONE CIRCUIT MUST CLOSE FIRST AND OPEN LAST.
2. MONITOR AND TRANSMIT BUTTONS ARE MECHANICALLY INTERLOCKED, MAKING IT NECESSARY TO PRESS MONITOR BUTTON BEFORE TRANSMITTING. TO MONITOR CONTINUOUSLY, PRESS MONITOR BUTTON DOWN AND SLIDE FORWARD TO "LOCK" POSITION. PRESS AND PUSH BACK BUTTON RELEASE. TO OPERATE MONITOR AND TRANSMIT FUNCTIONS INDEPENDENTLY, REMOVE LOCKING ARM BRACKET (PART 21 SHOWN ABOVE AND IN PARTS LIST).

RC-302A
SHEET 2

PARTS LIST

LBI-3623B

MAGNETIC CONTROLLED DESK MICROPHONE

MODEL 4EM28A10 (19C307105-P1)
MODEL 4EM28B10 (19C307106-P1)
(SEE RC-1227)

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS
		MODEL 4EM28A10
1		Pushbutton. Shure Brothers RP-68.
2		Washer. Shure Brothers 30A697.
3		Spring. Shure Brothers 44A149.
4		Cap and grille. Shure Brothers RP-72.
5		Magnetic controlled cartridge. Shure Brothers RP-13.
6		Washer. Shure Brothers 34A223.
7		Shield. Shure Brothers 53A528.
8		Damping pad. Shure Brothers 20E33.
9		Housing. (Part of item 4).
10		Base. (Part of item 4).
11		(Not used).
12		Pin. Shure Brothers 31A848.
13		Bracket. Shure Brothers 53A637.
14		Cable and plug. Shure Brothers RP-65.
15		Cable clamp. Shure Brothers 53A532.
16		Bottom plate. Shure Brothers 90A1015.
17		(Not used).
18		Mounting bracket. Shure Brothers 53A633.
19		Switch. Shure Brothers RP-70.
		MODEL 4EM28B10
1		(Not used).
2		Washer. Shure Brothers 30A697.
3		Spring. Shure Brothers 44A149.
4		Cap and grille. Shure Brothers RP-72.
5		Magnetic controlled cartridge. Shure Brothers RP-13.
6		Washer. Shure Brothers 34A223.
7		Shield. Shure Brothers 53A528.
8		Damping pad. Shure Brothers 20E33.
9		Housing. (Part of item 4).
10		(Not used).
11		Base. (Part of item 4).
12		Pin. Shure Brothers 31A848.
13		Bracket. Shure Brothers 53A637.
14		(Not used).
15		Cable clamp. Shure Brothers 53A532.
16		(Not used).
17		Bottom plate. Shure Brothers 90B1015.
18		Mounting bracket. Shure Brothers 53A633.
19		Switch. Shure Brothers RP-71.
20		Pushbutton (Transmit). Shure Brothers RP-69.
21		Locking arm. Shure Brothers 53A667.
22		Cable and plug. Shure Brothers RP-66.
23		Switch. (Part of item 19).
24		Pushbutton (Monitor). (Part of item 20).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

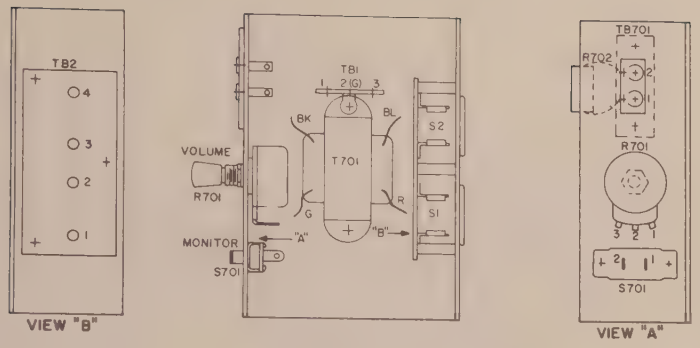
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

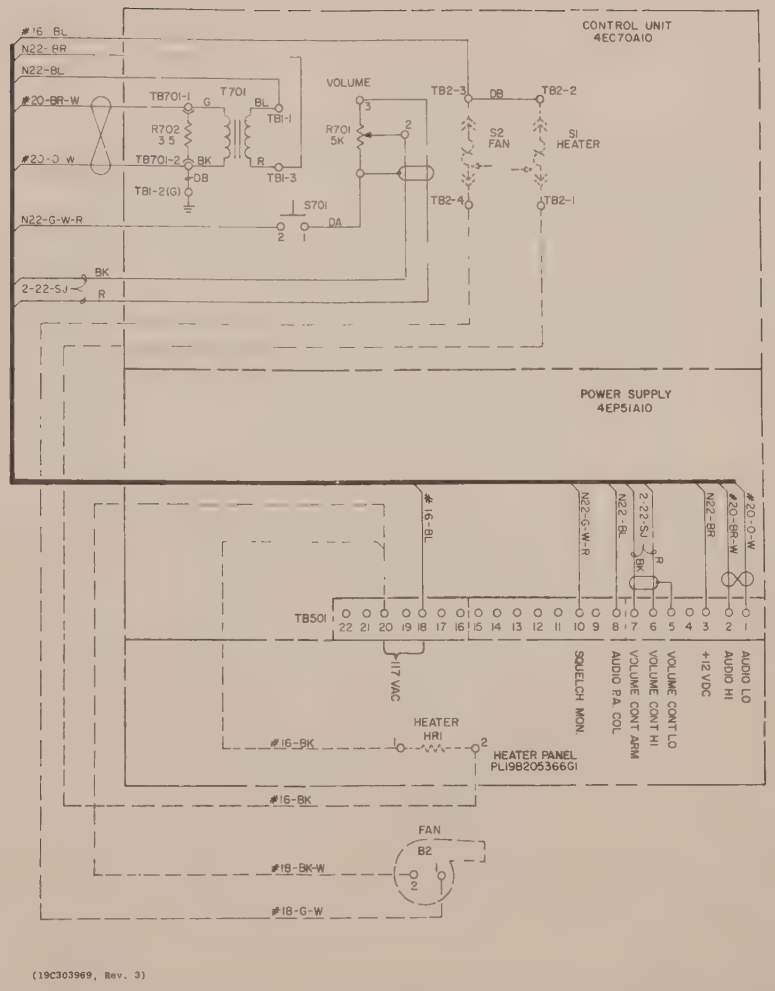
REV. A - Models 4EC69A10 - 12

To make Channel Guard disable a standard function. Changed S702.

REV. B - To provide volume control that is separate from power switch. Replaced OFF-VOLUME control R701/S701 with volume control R701. (Power OFF-ON switch is now on the power supply).



(19C311223, Rev. 0)



(19C303969, Rev. 3)

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EC70A10	

SCHEMATIC & OUTLINE DIAGRAM

WALL MOUNT CONTROL UNIT
MODEL 4EC70A10

RC-1422D

PARTS LIST

LBI-3721B

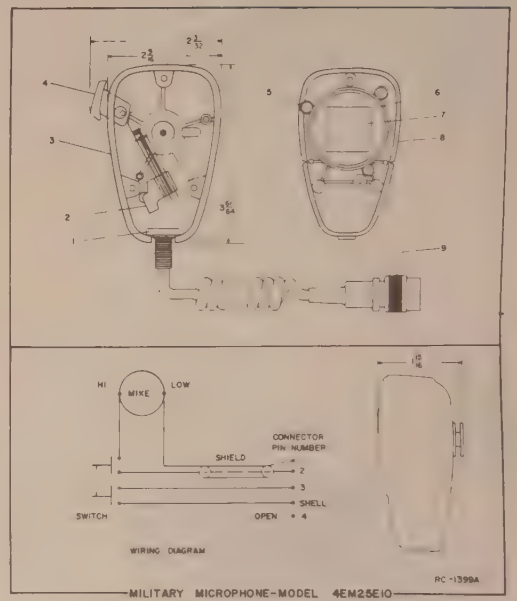
WALL MOUNT CONTROL UNIT
MODEL 4EC70A10
(19C303959G1)

SYMBOL	GE PART NO.	DESCRIPTION
		RESISTORS
R701	5496870P14	Variable, carbon film: 5000 ohms ±20%, 0.5 w; sim to Mallory LC(5K).
R702	7141971G1	Resistor kit: wirewound, 3.5 ohms ±10%, 4 w; sim to Clarostat Type C4GJ (modified).
		SWITCHES
S701	4031922P1	Push: SPST, normally open, momentary contact, 0.5 amp at 12 VDC; sim to Stackpole Type SS-15.
		TRANSFORMERS
T701	19A115612P1	Audio freq: 0.3-3 KHz freq range, Pri: 24.5 ohms ±5% imp, 1.38 ohms DC res, Sec 3.3 ohms imp, 0.18 ohm DC res.
		TERMINAL BOARDS
TM1	7775500P7	Phen: 3 terminals.
TB2	19A122201G1	Board: 4 terminals.
TB701	7117710P2	Phen: 2 terminals; sim to Cinch 1781.
		ASSOCIATED ASSEMBLIES
		SPEAKER AND MICROPHONE OPTION MILITARY MICROPHONE MODELS 4EM25E10 TWO-WATT SPEAKER MODEL 4EZ20A11
		MILITARY MICROPHONE MODEL 4EM25E10 (19B209102P2) (See RC-1163)
1		Cable clamp, front and back case. Shure Brothers RP96.
2		Switch. Shure Brothers RP26.
3		(See item 1).
4		Switch button. Shure Brothers RP97. (Quantity 5 only).
5		Spring and internal hardware. Shure Brothers RP16.
6		Shield. Shure Brothers RP23. (Quantity 5 only).
7		Magnetic controlled cartridge, grille cloth, screen and resonator. Shure Brothers RP13.
8		(See item 1).
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.
		TWO-WATT SPEAKER MODEL 4EZ20A11 (19C320302)
		LOUDSPEAKERS
LS2	19A116910P1	Permanent magnet: 5 inch, 3.2 ohms ±15% imp, 5 w max operating; sim to Pioneer 002009.
		CABLES
W2		**CABLE 19A122167G1**
		PLUGS
P702	5493018P2	Connector, phenolic: 5 contacts; sim to Cinch 204-31-05-010.

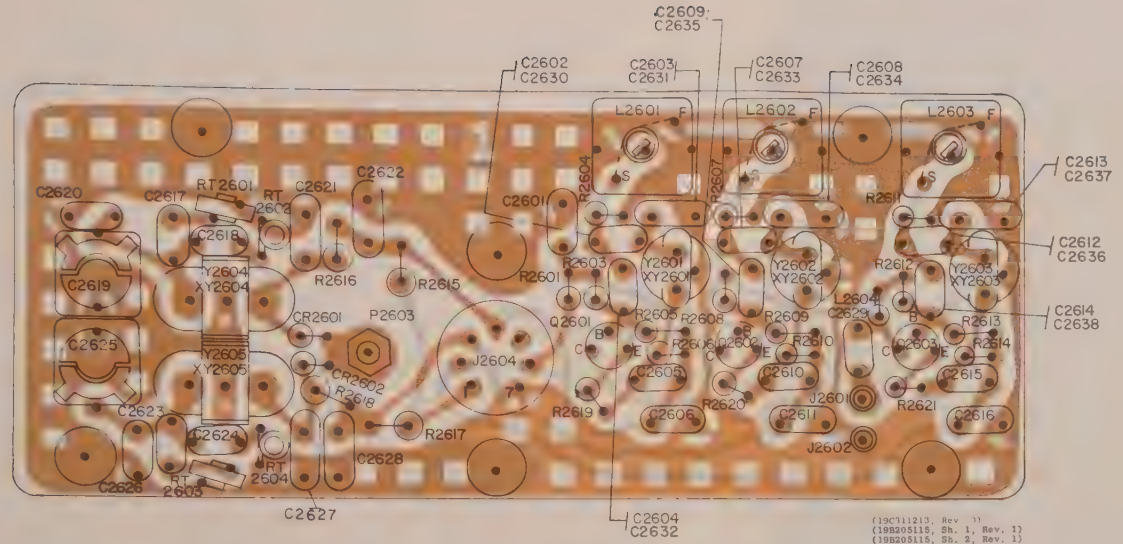
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		MISCELLANEOUS
	19A116986P108	Screw, thread forming, assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 1/2. (Mount speaker).
	19A116986P112	Screw, thread forming, assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 3/4. (Housing to grille).
	N130P1710C13	Tap screw. (Secures housing to wall).
	19A116985P1	Screw, hex head-slotted: double lead thread, with internal tooth washer, No. 13-16 x 3/4. (Mounts bracket to housing).
	19C320016P2	Mounting bracket.
	19D416396P2	Housing.
	19B21969262	Grille.
		FAN KIT 19A122295G2
		MOTORS
B2	19B205437G1	Fan, single phase: 115 VAC, 60 Hz, 14 w, ccw rotation; sim to Rotran "Gold Seal Venturi Muffin Fan".
		SWITCHES
S2	19A115687P2	Thermostatic: temp range 110°F ±6° closed, 90°F ±5° open; rated 5 amps at 240 VAC.
		HEATER 19A122203G1
		HEATERS
HR1	4034002P1	Strip: 120 VAC, 150 w nominal; sim to GE 2A425-G16.
		SWITCHES
S1	19A115687P1	Thermostatic: temp range 3°F ±6° closed, 18°F ±5° open, 5 amps at 240 VAC.
		MISCELLANEOUS
	7150186P19	Spacer: No. 4. (Used with TB2 in 19C303959-G1).
	19A115308P1	Knob. (Used in 19C303959-G1).
	N529P42C13	Button, plug. (Used in 19C303959-G1).
	[illegible]	Grille. (Used in 19D402449-G6).
	19A121521G1	Support, mounting. (Used in 19D402449-G6).
	5190407P3	Grommet, rubber. (Located top of casting in 19D402449-G6).
	19A115470P1	Grommet, rubber. (Located bottom of casting in 19D402449-G6).
	19C303504G3	Housing, speaker. (Used in 19D402449-G6).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



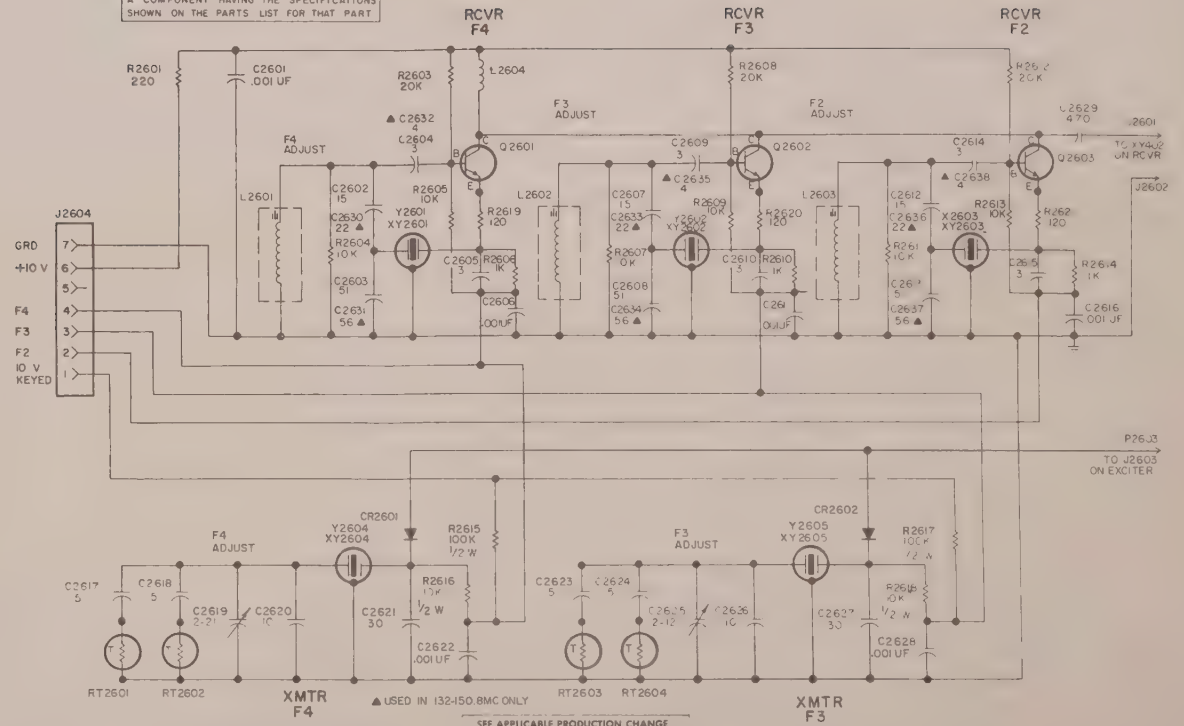
MILITARY MICROPHONE-MODEL 4EM25E10



(19C111213, Rev. 1)
(19B205115, Sh. 1, Rev. 1)
(19B205115, Sh. 2, Rev. 1)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EG22F10	C
4EG22F11	C

(19C303926, Rev. 8)

SCHEMATIC & OUTLINE DIAGRAM

FOUR-FREQUENCY OSCILLATOR BOARD
MODEL 4EG22F10, 11
RC-1418E
****

PARTS LIST

LBI-3715C

132-174 MHz FOUR FREQUENCY OSCILLATOR BOARD
MODELS 4EG22F10, 11
(19C303924-G1, 2)

SYMBOL	G-E PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C2601	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2602*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2603	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2604*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2605	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2606	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2607*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2608	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2609*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2610	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2611	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2612*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2613	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2614*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2615	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2616	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2617 and C2618	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2619	5491271-P106	Variable, air: approx 1.98-12.4 µf, 750 v peak; sim to EF Johnson 189-6-5.
C2620	5496219-P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2621	5496219-P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2622	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	G-E PART NO	DESCRIPTION
C2623 and C2624	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2625	5491271-P106	Variable, air: approx 1.98-12.4 pf, 750 v peak; sim to EF Johnson 189-6-5.
C2626	5496219-P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2627	5496219-P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2628	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2629	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2630*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2631	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2632*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2633*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2634	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2635*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2636*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2637	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2638*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		------- DIODES AND RECTIFIERS -------
CR2601 and CR2602	19A115371-P1	Silicon; sim to Type 1N676.
CR2603	4037822-P1	Silicon.
		------- JACKS AND RECEPTACLES -------
J2601 and J2602	4033513-P4	Contact, electrical: sim to Bead Chain L93-3.
J2604	19B209303-P2	Connector, phen: 7 pins.
		---------- INDUCTORS ----------
L2601 thru L2603	19A121085-G1	Coil. Includes tuning slug 19B200497-P2.
L2604	7488079-P1	Choke, RF: 0.15 µh ±20%, .03 ohm DC res max; sim to Jeffers 4411-1.
		---------- PLUGS ----------
P2603	4029093-P1	Plug, banana type: sim to Ucinite 155296.

SYMBOL	G-E PART NO	DESCRIPTION
		---------- TRANSISTORS ----------
Q2601* thru Q2603*	19A115025-P1	Silicon, NPN.
	19A115342-P2	In Models earlier than Rev C: Silicon, NPN.
		---------- RESISTORS ----------
R2601	3R152-P221K	Composition: 220 ohms ±10%, 1/4 w.
R2603	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2604 and R2605	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2606	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2607	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2608	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2609	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2610	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2611	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2612	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2613	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2614	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2615	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R2616	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R2617	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R2618	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R2619* thru R2621*	3R152-P121J	Composition: 120 ohms ±5%, 1/4 w.
	3R152-P150J	In Models earlier than Rev B: Composition: 15 ohms ±5%, 1/4 w.
		---------- THERMISTORS ----------
RT2601	19B209353-P2	Disc: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2602	19B209353-P1	Rod: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
RT2603	19B209353-P2	Disc: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2604	19B209353-P1	Rod: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
		---------- CABLES ----------
W2601		CABLE 19B205275-G1
		---------- MISCELLANEOUS ----------
	19B209341-P1	Socket: 7 contacts; sim to Elco 04-720-XX.
W2602		CABLE 19B205263-G1
		---------- MISCELLANEOUS ----------
	4029840-P1	Contact, electrical: sim to AMP 41854.
		---------- SOCKETS ----------
XY2601 thru XY2603	5490277-P1	Transistor, phen: 4 contacts; sim to Elco 3303.
XY2604 and XY2605		(See Miscellaneous).
		---------- CRYSTALS ----------
		When reordering give GE Part Number and specify exact frequency needed.
		Receiver Crystal freq = (OF -10.7 MHz) ÷ 3.
Y2601 thru Y2605	19B208221-P1	Quartz: freq range 39 to 62 MHz, temp range -30°C to +80°C. (Receiver).

SYMBOL	G-E PART NO	DESCRIPTION
		Transmitter Crystal freq = (OF) ÷ 24.
Y2601 thru Y2605	19B206204-P1	Quartz: freq range 5400 to 7250 KHz, temp range -30°C to +85°C. (Transmitter).
		---------- MISCELLANEOUS ----------
	4033089-P1	Clip. (Part of XY2604, 2605).
	19A115793-P1	Contact, electrical: sim to Malco 2700. (Part of XY2604, 2605).
	19C311172-P1	Socket: 4 contacts. (Part of XY2604, 2605).
	19A121088-P1	Can. (Used with L2601-2603).

PRODUCTION CHANGES

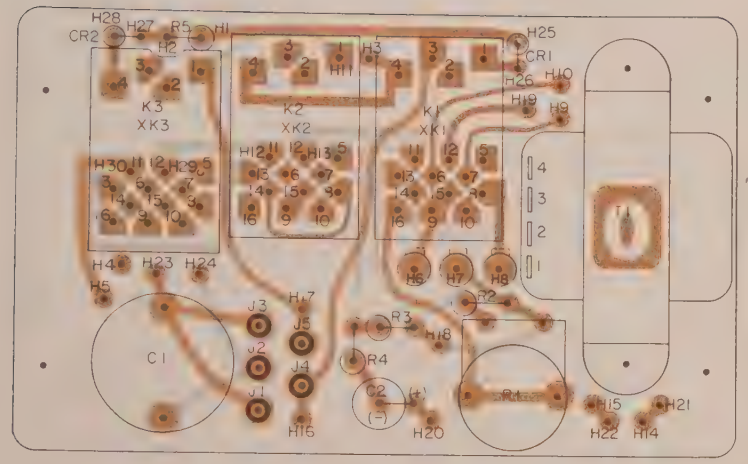
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To improve receiver oscillator frequency stability. Changed C2602, C2607, C2612, C2630, C2633 and C2636.

REV. B - To improve the frequency stability of the receiver oscillators. Changed C2602, C2604, C2607, C2609, C2612, C2614, C2630, C2632, C2633, C2635, C2636, C2638, R2619, R2620 and R2621.

REV. C - To incorporate new transistors. Changed Q2601, Q2602 & Q2603.

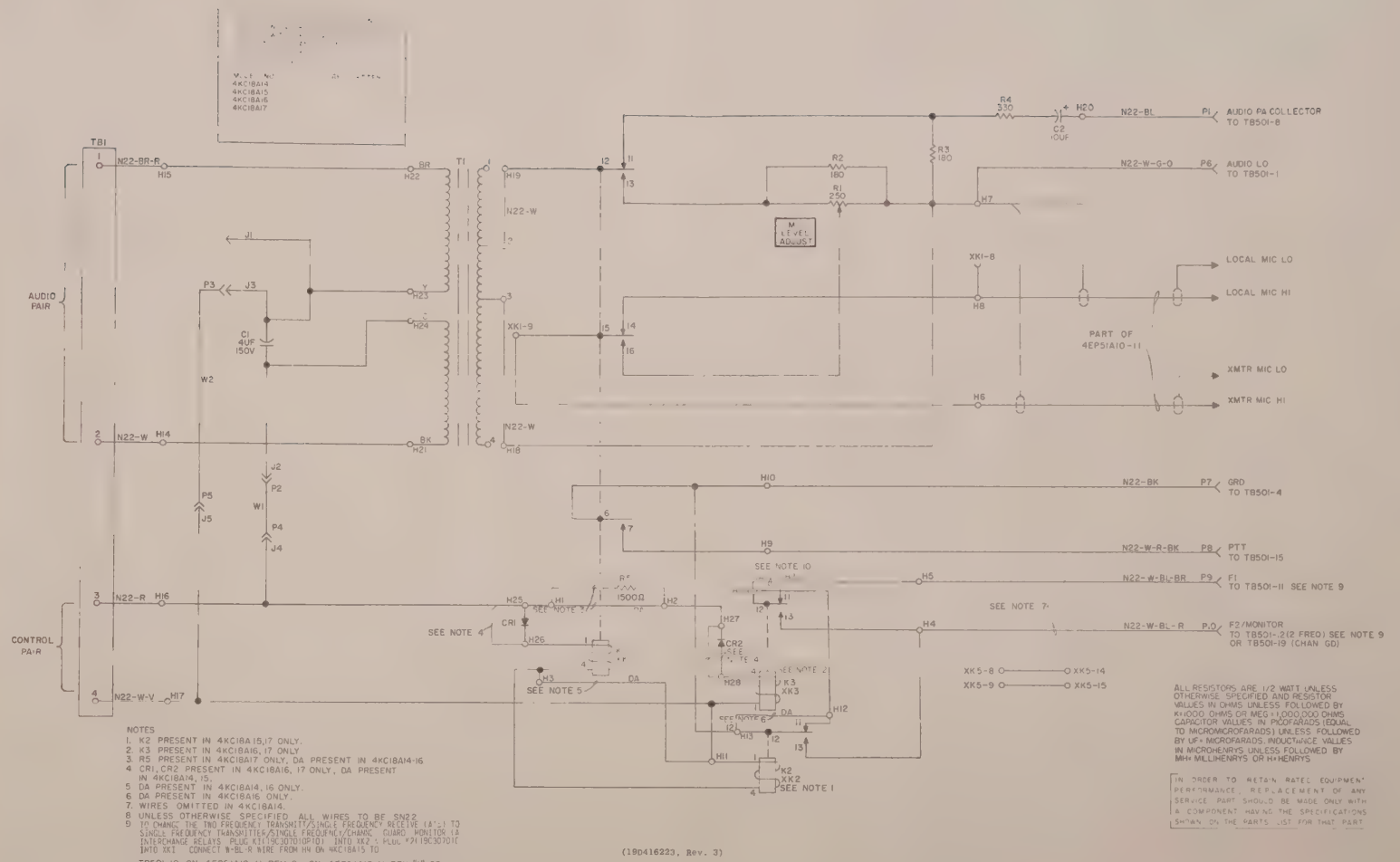
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



POLARITY OF CR1 & CR2

(19B219486, Rev. 2)
(19B219361, Sh. 1, Rev. 0)
(19B219361, Sh. 2, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE



NOTES
1. K2 PRESENT IN 4KC18A15,17 ONLY.
2. K3 PRESENT IN 4KC18A16, 17 ONLY
3. R5 PRESENT IN 4KC18A17 ONLY, DA PRESENT IN 4KC18A14-16
4. CR1, CR2 PRESENT IN 4KC18A16, 17 ONLY, DA PRESENT IN 4KC18A14, 15,
5. DA PRESENT IN 4KC18A14, 16 ONLY.
6. DA PRESENT IN 4KC18A15 ONLY.
7. WIRES OMITTED IN 4KC18A14.
8. UNLESS OTHERWISE SPECIFIED ALL WIRES TO BE SN22.
9. TO CHANGE THE TWO FREQUENCY TRANSMIT/SINGLE FREQUENCY RECEIVE (A':) TO SINGLE FREQUENCY TRANSMITTER/SINGLE FREQUENCY/CHANG GUARD MONITOR (A INTERCHANGE RELAYS PLUG K1(19C307010P10) INTO XK2 ; PLUG #2(19C307010 INTO XK1 CONNECT W-BL-R WIRE FROM H4 ON 4KC18A15 TO TB501-10 ON 4EP51A10-11 REV 0. ON 4EP51A10-11 REV "A" OR LATER, CONNECT W-BL-R WIRE FROM H4 ON 4KC18A15 TO TB501-19. REMOVE & DISCARD W-BL-BR WIRE FROM H5 IN 4KC18A15 TO TB501-11 ON 4EP51A10-11.
10. DA PRESENT IN 4KC18A15 ONLY
11. TERMINATE ALL WIRES TO TB501 WITH 19B209260P103.

(19D416223, Rev. 3)

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC & OUTLINE DIAGRAM

REMOTE CONTROL BOARD MODELS 4KC18A14—17

(RC-2233A)

PARTS LIST

LBI-4274

REMOTE CONTROL BOARD
MODELS 4KC18A14 THRU 17

SYMBOL	GE PART NO.	DESCRIPTION
		CAPACITORS
C1	7486445P5	Electrolytic, non polorized: 4 µf +100% -10%, 150 VDCW.
C2	7489483P7	Electrolytic: 10 µf +75% -10%, 25 VDCW; sim to Sprague 30D.
		DIODES AND RECTIFIERS
CR1 and CR2	4037822P1	Silicon.
		JACKS AND RECEPTACLES
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		RELAYS
K1	19C307010P10	Armature: 28 VDC, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K2	19C307010P11	Armature: 30 VDC, 1.5 w operating, 1550 ohms ±10% coil res, 1 form A, 1 form C, 1 form D contacts; sim to Allied Control TS-154-X-01.
K3	19C307010P10	Armature: 28 VDC, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
		RESISTORS
R1	19B209358P1	Variable, carbon film: approx 25 to 250 ohms ±20%, 0.2 w; sim to CTS Type U-201.
R2 and R3	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R4	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R5	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
		TRANSFORMERS
T1	19A115731P1	Audio freq: 300 to 6000 Hz, Pri (1-4): 22 ohms ±15% DC res, Pri (2-3): 12.5 ohms ±15% DC res, Sec 1: 13 ohms ±15%, Sec 2: 13 ohms ±15%.
		TERMINAL BOARDS
TB1	7117710P4	Phen: 4 terminals; sim to Cinch 1774.
		CABLES
W1		CABLE 4037741G1
		PLUGS
P2	4029840P1	Contact, electrical; sim to Amp 41854.
P4	4029840P1	Contact, electrical; sim to Amp 41854.
W2		CABLE 4037741G1
		PLUGS
P3	4029840P1	Contact, electrical; sim to Amp 41854.
P5	4029840P1	Contact, electrical; sim to Amp 41854.
		SOCKETS
XK1 thru XK3	5481585P7	Relay: 10 contacts; sim to Allied Control 30054-4.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

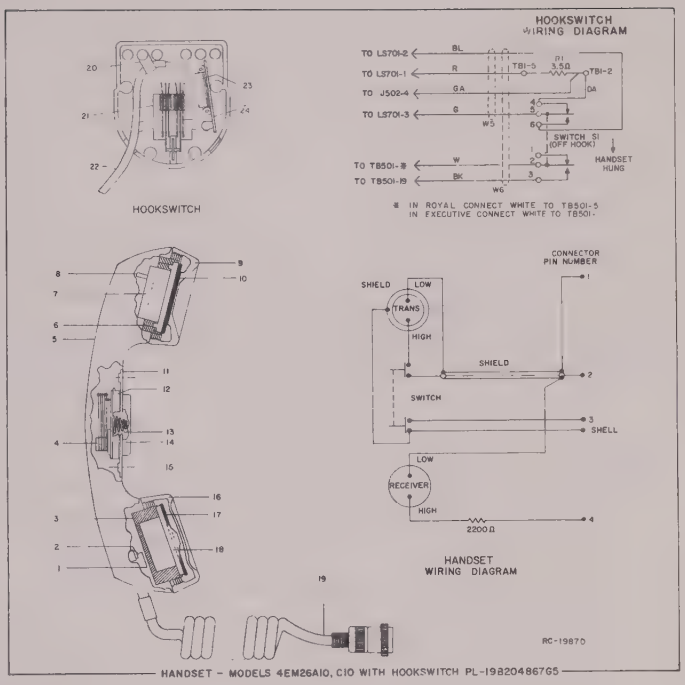
PARTS LIST

LBI-4120B

HANDSET MODEL 4EM26A10
HANDSET MODEL 4EM26C10
HOOKSWITCH 19B204867G5
AND ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		(Refer to RC-1987)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers RP19.
4		Switch. Shure Brothers RP81.
5		Case. Shure Brothers RP49. (Used with 4EM26A10).
		Case. Shure Brothers 21RP899F. (Used with 4EM26C10).
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge, Receiver. Shure Brothers RP41.
8	3R77P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. (Part of item 5).
10		Washer. Shure Brothers 34A321.
11		Escutcheon. Shure Brothers 53A536A.
12		Actuator. Shure Brothers 53A556.
13		Spring. Shure Brothers 44A140.
14		Plunger bar. Shure Brothers RP82.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. (Part of item 5).
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge, Transmitter. Shure Brothers RP13.
19		Cable and plug. Shure Brothers RP48. (Used with 4EM26A10).
		Cable and plug. Shure Brothers 21RP738F. (Used with 4EM26C10).
		HOOKSWITCH 19B204867G5
20	4029851P5	Cable clamp; sim to WEC Kesser 2/16-4.
21	19A121612P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19B205667G1	Cable: approx 8-1/2 feet long.
23	5493035P10	Resistor, wirewound, ceramic: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-50.
24	7775500P55	Terminal board, phen: 5 terminals.
		ASSOCIATED ASSEMBLIES EXTENSION CABLE 19B204988G4
	7478726P6	Plug: 4 contacts, sim to Amphenol 91-MC4M.
	4034669P4	Cable, 6 ft.
	19A116061P1	Receptacle: 4 contacts; sim to Amphenol 91-PN4F-1000.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



HANDSET - MODELS 4EM26A10, C10 WITH HOOKSWITCH PL-19B204867G5

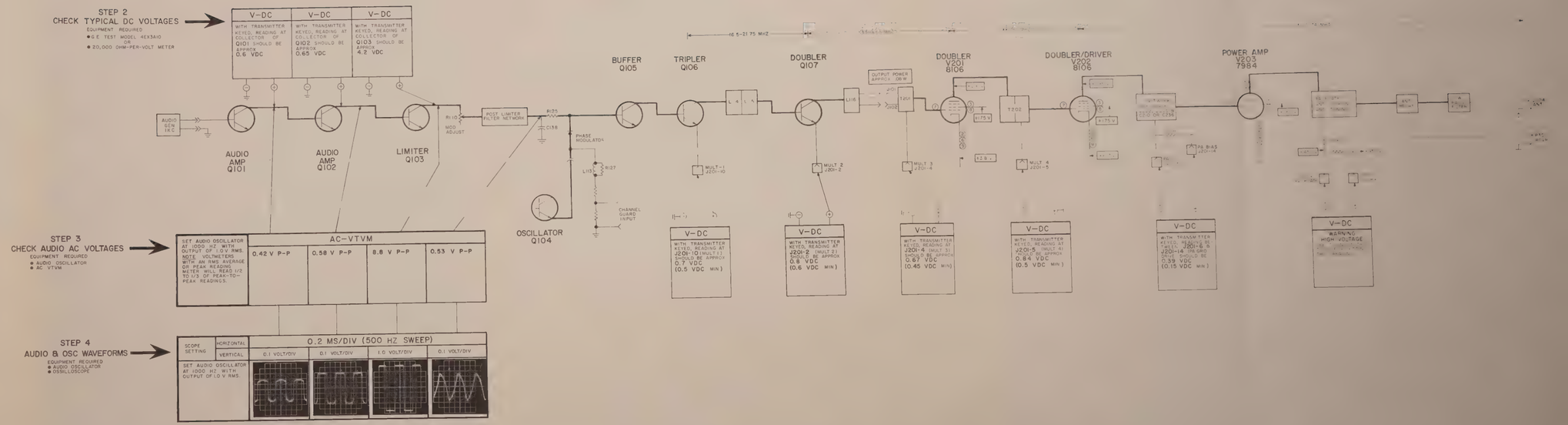
SCHEMATIC & OUTLINE DIAGRAM

HANDSET MODELS 4EM26A10 & C10
HOOKSWITCH 19B204867G5

RC-1424F

STEP 1 - QUICK CHECKS

Power Out	A	B	D	E	F	G	I	Probable Defect
low	0.7	0.8	0.7	0.8	0.3	0.7	10	weak 7984
low	0.7	0.8	0.7	0.8	0.1	0.7	10	weak 8106 V202
low	0.7	0.8	0.7	0.3	0.1	0.7	10	weak 8106 V201
0	0.7	0.8	0.7	0.8	0.3	0	10	defective 7984
0	0.7	0.8	0.7	0.8	0	0	10	defective 7984
0	0.7	0.8	0.7	0.8	0	0.8	10	defective bias supply
0	0.7	0.8	0.7	0	0	0	10	V202 failure
0	0.7	0.8	0	0	0	0	10	V201 failure, open coax to exciter board or Q107 defective
0	0.7	0	0	0	0	0	10	Q107 defective
0	0	0	0	0	0	0	0	10 v regulator defective


STEP 2
CHECK TYPICAL DC VOLTAGES
EQUIPMENT REQUIRED
● G E TEST MODEL 4EX3A10
OR
● 20,000 OHM-PER-VOLT METER
V-DC
WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q101 SHOULD BE APPROX 0.6 VDC
V-DC
WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q102 SHOULD BE APPROX 0.65 VDC
V-DC
WITH TRANSMITTER KEYED, READING AT COLLECTOR OF Q103 SHOULD BE APPROX 4.2 VDC
AUDIO GEN 1KC
AUDIO AMP Q101
AUDIO AMP Q102
LIMITER Q103
R110 MOD ADJUST
POST LIMITER FILTER NETWORK
R135
C138
PHASE MODULATOR
L131
R127
CHANNEL GUARD INPUT
OSCILLATOR Q104
BUFFER Q105
TRIPLER Q106
DOUBLER Q107
DOUBLER V201 8106
DOUBLER/DRIVER V202 8106
POWER AMP V203 7984
OUTPUT POWER APPROX 08 W
T201
T202
L116
MULT-1 J201-10
MULT 2 J201-2
MULT 3 J201-4
MULT 4 J201-5
PA BIAS J201-14
+175 V
+12 V
V-DC
WITH TRANSMITTER KEYED, READING AT J201-10 (MULT-1) SHOULD BE APPROX 0.7 VDC (0.5 VDC MIN.)
V-DC
WITH TRANSMITTER KEYED, READING AT J201-2 (MULT 2) SHOULD BE APPROX 0.8 VDC (0.6 VDC MIN.)
V-DC
WITH TRANSMITTER KEYED, READING AT J201-4 (MULT 3) SHOULD BE APPROX 0.67 VDC (0.45 VDC MIN.)
V-DC
WITH TRANSMITTER KEYED, READING AT J201-5 (MULT 4) SHOULD BE APPROX 0.84 VDC (0.5 VDC MIN.)
V-DC
WITH TRANSMITTER KEYED, READING AT J201-14 (PA BIAS) SHOULD BE 0.39 VDC (0.15 VDC MIN.)
V-DC
WARNING HIGH VOLTAGE
STEP 3
CHECK AUDIO AC VOLTAGES
EQUIPMENT REQUIRED
● AUDIO OSCILLATOR
● AC VTVM
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 1.0 V RMS.
NOTE VOLTMETERS WITH AN RMS-AVERAGE OR PEAK READING METER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS.
AC-VTVM
0.42 V P-P
0.58 V P-P
8.8 V P-P
0.53 V P-P
STEP 4
AUDIO & OSC WAVEFORMS
EQUIPMENT REQUIRED
● AUDIO OSCILLATOR
● OSSILLOSCOPE
SCOPE SETTING
HORIZONTAL
0.2 MS/DIV (500 HZ SWEEP)
VERTICAL
0.1 VOLT/DIV
0.1 VOLT/DIV
1.0 VOLT/DIV
0.1 VOLT/DIV
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 1.0 V RMS.

STEP 1 - QUICK CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	Check power connections and continuity of supply leads, and check fuses. If fuse is blown, check for short circuits by disconnecting all plugs in the unit. Reconnect plugs one at a time until a fuse blows.
NO REGULATED 10 VOLTS	Check the 12-volt supply. Then check Q1 in 10-volt regulator and regulator circuit. Disconnect all plugs from the receiver, exciter board and option boards, and take resistance readings from jack pins to ground (Refer to Outline Diagrams).
LOW 2ND LIM READING	Check supply voltages and then check oscillator reading at J304-4 as shown in STEP 2A. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 2nd Limiter stages as shown in STEP 2A. Check receiver RF alignment (refer to Receiver Alignment Procedure).
LOW OSCILLATOR READING	Check alignment of Oscillator (Refer to Front End Alignment Procedure). Check voltage readings of Q304 and Q305. Check resistance readings on J302-1, -2 and -3. Check crystal Y401.
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check input signal required for 0.2-volt reading at LIM-1. Reading should be less than 20 uv. Check antenna connections, cable and relay. Check voltage readings of 1st and 2nd RF Amps and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA (Q505) output current at J304-9. If reading is low -- a. Check BIAS ADJ for 0.28 VDC at J304-9. If incorrect, set for 0.28 v with R401 (Position on Test Set). b. If correct, check Audio Amp Q317. Make SIMPLIFIED GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch Stages. Check unsquelched D-C voltage readings in Audio section (Refer to Receiver Service Sheet). Check voltage readings on Channel Guard receiver. Check setting of SQUELCH control R400 (Refer to Receiver Alignment Procedure).
IMPROPER SQUELCH OPERATION	Make GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check voltage readings of Squelch circuit (Refer to Receiver Service Sheet).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

(DF-1090)

STEP 3- GAIN-PER-STAGE READINGS-

EQUIPMENT REQUIRED:

1. RF VOLTMETER (SIMILIAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18 C
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

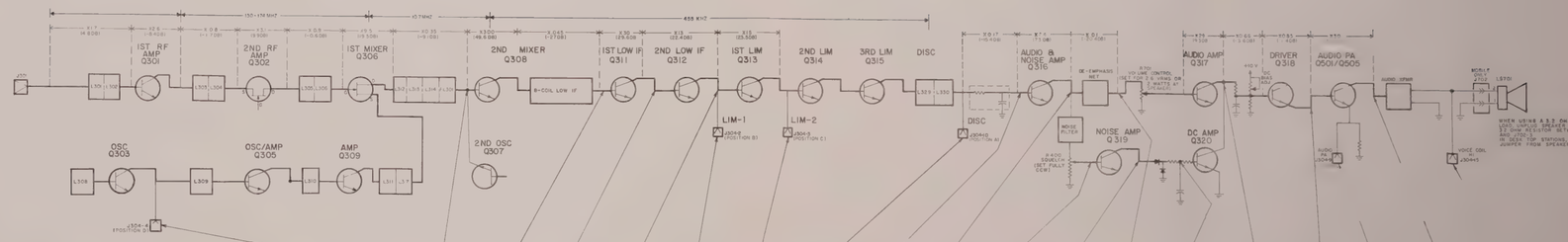
PROCEDURE:

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E$_1$).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER) REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E$_2$).
3. CONVERT READINGS (BY SUBTRACTING E$_1$ FROM E$_2$ ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA:

   AMP FACTOR $\frac{E_2}{E_1}$

4. CHECK RESULTS WITH TYPICAL GAINS SHOWN ON DIAGRAM BELOW.
5. USE PROCEDURE LISTED ABOVE TO FIND GAIN OF EACH STAGE.

NOTE: REMOVE CRYSTAL OR SHORT OUT OSC. BASE BEFORE MEASURING MIXER STAGES TO ELIMINATE INJECTION VOLTAGE.


150-174 MHZ
10.7MHZ
455 KHZ
IST RF AMP Q301
2ND RF AMP Q302
IST MIXER Q306
2ND MIXER Q308
B-COIL LOW IF
1ST LOW IF Q311
2ND LOW IF Q312
IST LIM Q313
2ND LIM Q314
3RD LIM Q315
DISC
AUDIO & NOISE AMP Q316
DE-EMPHASIS NET.
AUDIO AMP Q317
DRIVER Q318
AUDIO PA Q501/Q505
OSC Q303
OSC/AMP Q305
AMP Q309
2ND OSC Q307
LIM-1
LIM-2
NOISE AMP Q 319
DC AMP Q320
J501
J304-4 POSITION D
J304-9 POSITION B1
J304-9 POSITION C1
J304-9 POSITION A1
J304-9
J304-9
J304-9

QUICK CHECKS

SYMPTOM	CHECK FOR:
No output voltages at TB3	1. Blown fuses F501, F502, F503 & F504. 2. Defective switch S701. 3. Short or open in primary of T501 or T502. 4. Relay contacts K501.
No high B+	1. Shorted C502, C503, C504 or T501. 2. Open F502, L501, T501 or shorted CR505 thru CR510.
No low B+	1. Shorted CR507 thru CR510, C505 or T501. 2. Open F503, L502 or T501.
No -55 volts	1. Shorted CR501, CR502 or T501. 2. Open T501, R501, CR501 or CR502.
No 13.6 volts	Open CR511, CR512, F504, L503 or T502.
B+ output with transmitter not keyed	Burned relay contacts or shorted C507.
Low output voltages	1. Open diodes. 2. Excessive load (short in transmitter).
Excessive output ripple voltage	1. Open diodes. 2. Open C501 thru C506, C508 thru C510.
10-VOLT REGULATOR	
No output	1. 12 V at input of regulator. 2. C to E open circuit in Q1. 3. Open R5. 4. Short between emitter of Q1 and ground. 5. Open T501, F504, L503.
Output too high - cannot adjust with R3	1. Open in VR1 or Q2. 2. Defective R3.
Output equals input	Shorted Q1.
Regulation poor but output is adjustable with R3	Q1 is probably defective and should be replaced.

TROUBLESHOOTING PROCEDURES

POWER SUPPLY MODEL 4EP51A10

(RC-1434A)

This modification for 132-174 MHz receivers Type ER-48-C reduces the susceptibility of the receiver to intermodulation interference by decreasing the receiver sensitivity.

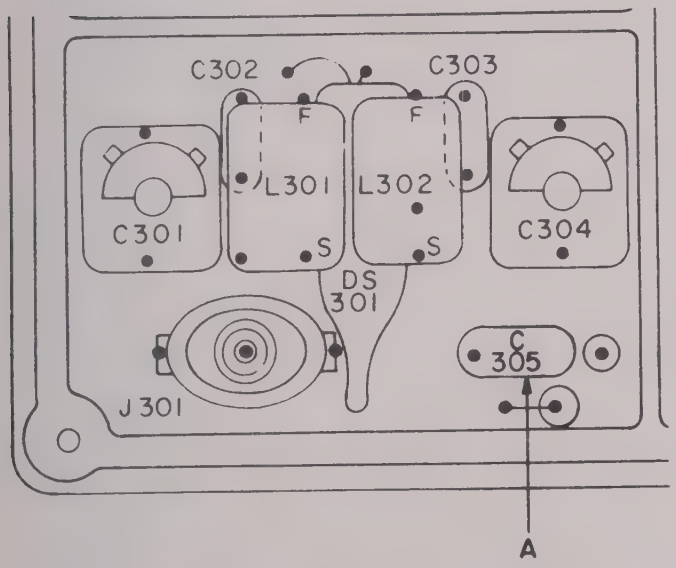
PROCEDURE

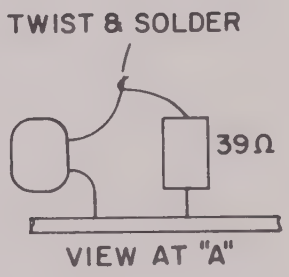
1. Remove the top cover from the receiver.

2. Unsolder the lead of capacitor C305 (see Figure 1) and solder one lead of a 39-ohm, 5%, 1/4-watt resistor (GE Part No. 3R152P390J) into the hole from which the capacitor lead was removed.

3. Solder the other lead of the resistor and capacitor together as shown in View "A".

4. Replace the top cover.





RC-2392

Figure 1 - Installation Diagram

TEST SPECIFICATIONS

1. Receiver specification changes are as follows:

20-dB Quieting	0.6 microvolts
12-dB SINAD	0.4 microvolts
EIA Intermodulation	unchanged (-70 dB)
Critical Squelch	less than 12-dB SINAD

2. More receiver sensitivity degradation can be obtained by increasing the value of the 39-ohm resistor in small increments.

DF-1090

MODIFICATION INSTRUCTIONS

Reduction of Intermodulation Interference
(Option 8302)

RC-2400
****

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4331

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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ECP 199

MOBILE RADIO

MAINTENANCE MANUAL

CHANNEL GUARD ENCODER/DECODER MODELS 4EK14B10 & 4EK14B11
CHANNEL GUARD DECODE ONLY (OPTION 8026)
TONE REJECT FILTER 19C317355-G2

SPECIFICATIONS *

Used with 4EK14B10	MASTR® Progress Line Executive Series, Royal Executive Mobile and Station Combinations and MASTR Executive II Mobile and Station Combinations
4EK14B11	MASTR Progress Line Custom Executive Mobile Combinations
Tone Frequencies	71.9 to 203.5 Hertz
Encoder Distortion	Less than 3%
Decoder Response	±1.5 dB from 71.9 to 203.5 Hertz (100 Hz Ref.)
Power Requirements	10 VDC @ 50 Milliamperes
Number of Silicon transistors	8
Temperature Range	-30°C to +60°C (-22°F to 144°F)

EK-14-B

These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications

GENERAL ELECTRIC

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Channel Guard Encoder/Decoder Model 4EK14B10 8
Channel Guard Encoder/Decoder Model 4EK14B11 9

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Channel Guard Models 4EK14B10 and 4EK14B11 are fully transistorized Encoder/Decoder.

The encoder function provides coded tone modulation for the transmitter.

The decoder function is used with the receiver to eliminate all calls that are not tone coded for the channel guard frequency.

The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The channel guard board is located in the option area as shown in Figures 1 and 2.

Tone Reject Filter 19C317355G2 is available for use in a non-Channel Guard mobile or station receiving calls that are tone modulated.

INSTALLATION

To install Channel Guard board in the field, refer to the installation diagrams listed in the table of contents. In 25-50 MHz applications only, the transmitter exciter board has to be modified.

CIRCUIT ANALYSIS

References to symbol numbers mentioned in the following text are found on the Schematic Diagrams, Outline Diagrams and Parts Lists (see Table of Contents). A block diagram of the Channel Guard is shown in Figure 3.

Cable W603 (W604 for Royal) connects the supply voltage, encoder keying voltage and decoder functions for the Channel Guard board to the system terminal board (TB3). The encoder tone output is connected by a white-black shielded lead to the transmitter exciter board.

ENCODER

The encoder tone is provided by Q604 and Q605 which oscillate at a frequency determined by the tone network. Negative feedback, applied thru the tone network to the base of Q604, prevents any gain in the stage except at the operating frequency.

Keying the transmitter applied +10 Volts to the anode of feedback control diode CR605, causing it to conduct. When conducting, the diode shunts R635 which reduces the impedance of the positive feedback loop (R635, R633 and C617). This provides the necessary gain to the base of Q604 to permit oscillation, and the oscillator locks in on the Channel Guard frequency.

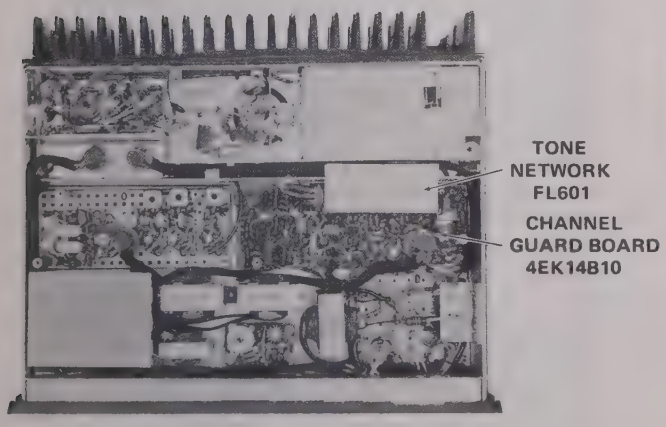


Figure 1 - Executive & Royal Executive

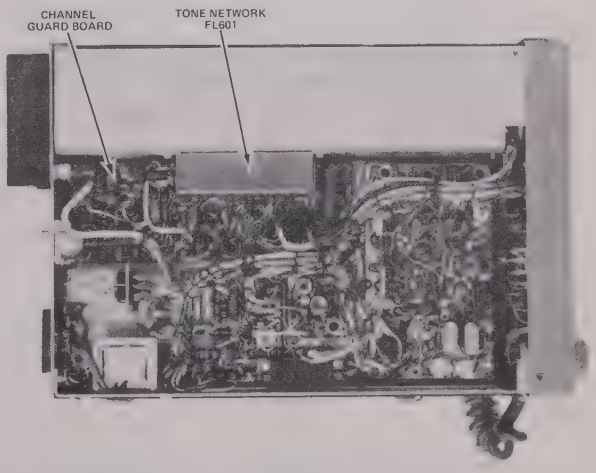


Figure 2 - Custom Executive

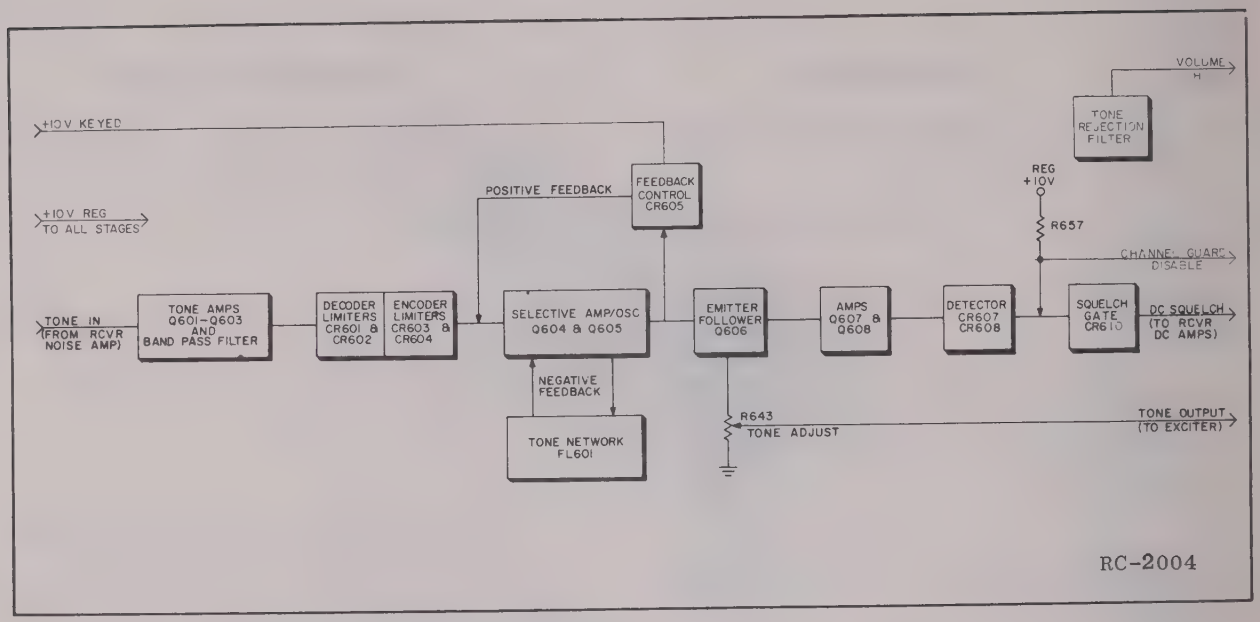


Figure 3 - Channel Guard Block Diagram

An extremely fast starting time for the encoder tone is provided by a starting network consisting of R641, C618, C619 and CR606. This network utilizes a positive pulse from the +10 Volts keying voltage to provide the positive feedback required to start oscillation.

Thermistor-resistor combination R663-RT604 provides temperature compensation for the oscillator output, and limiter diodes CR603 and CR604 keep the amplitude of the tone constant.

The oscillator output is fed to emitter-follower Q606, and then to TONE ADJUST potentiometer R643. This control is normally set for a ±0.75 kHz deviation as outlined in the Transmitter Modulation Adjustment Procedure.

The encoder tone is applied to the modulator stage on the transmitter exciter board.

DECODER

The decoder function is designed to eliminate all calls that are not tone coded for the Channel Guard Frequency. As long as the MONITOR switch is not depressed, all signals are locked out except those from transmitters that are continuously tone coded for positive identification by the receiver. Pressing the MONITOR switch instantly disables the Channel Guard and noise squelch circuits so that all calls on the channel can be heard.

Audio, tone and noise are taken from the collector of audio-noise amplifier Q316 in the receiver and is fed thru J601-4 to three tone amplifier and bandpass filter circuits. The filters remove the audio and high-frequency noise from the signal, and the tone amplifiers provide sufficient gain of all Channel Guard tones to insure clipping by limiter diodes CR601 and CR602. The clipping action eliminates variation in the squelch performance due to changes in tone deviation.

The signal is then applied to selective amplifiers Q604 and Q605, which amplify only the tone determined by the tone network.

The output of the selective amplifier is applied through emitter-follower Q606 to the high gain, broad-band tone amplifiers Q607 and Q608. The output of Q608 is rectified by detector diodes CR607 and CR608, and the resulting negative DC voltage controls the squelch gate. Q607 is normally biased for low gain. When the tone is detected by CR607 and CR608, feedback is provided through R655 to quickly change the bias on Q607 for full gain. This ensures a more positive "unsquelching" action.

Squelch gate diode CR610 is normally forward biased by a positive DC voltage (approximately 1.5 Volts) fed through R657. The forward bias causes CR610 to conduct, feeding a DC voltage to the base of noise amplifiers Q320 and Q321 in the receiver. This removes the bias on the receiver audio stages and holds them off.

When the proper tone is applied to the decoder, the negative DC voltage from the detector diodes CR607 & CR608 back-biases squelch gate diode CR610, and cuts off the positive bias to the DC amplifiers. However, the receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

Pressing the MONITOR switch on the control unit grounds the base biasing circuit of the DC amplifiers and disables both the Channel Guard and noise squelch circuits. If the optional hookswitch is provided, removing the microphone from its hanger automatically disables Channel Guard while maintaining normal noise squelch operation.

A tone rejection filter connected in parallel with the VOLUME control bypasses the tone to ground, thereby attenuating the tone level reaching the audio circuits. The filter is composed of L601, C624, C626, C629, C630 and R659.

ADJUSTMENT

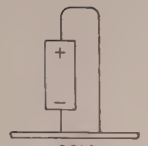
The decode function and the tone reject filter function requires no adjustment. To adjust the tone level of the encode function, proceed as follows:

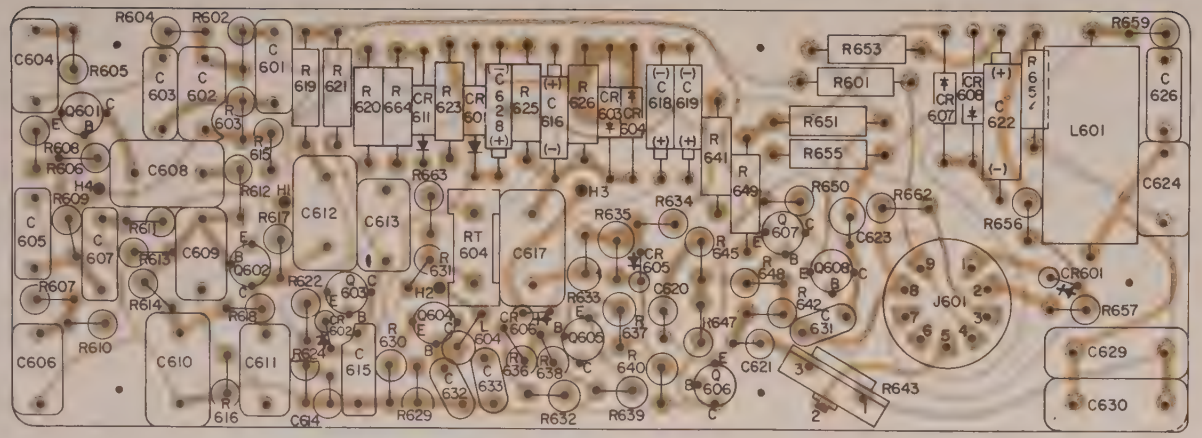
1. Connect a deviation monitor to the transmitter output.

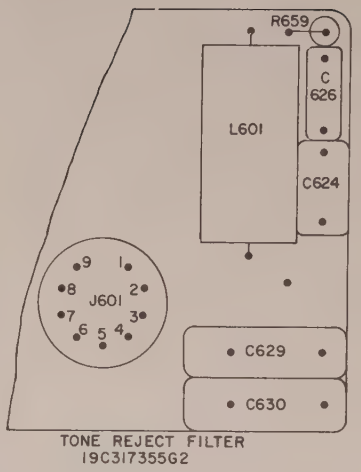
2. Key the transmitter and adjust R643 on the Channel Guard board for ±0.75 kHz deviation.

DECODE ONLY (MASTR EXECUTIVE II)

In MASTR Executive II Applications where the "decode only" function is desired, clip the W-BK wire connected to P907-6 between the connector body and sleeve.

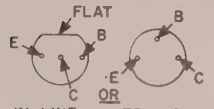






TONE REJECT FILTER
19C317355G2

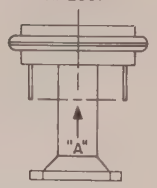
LEAD IDENTIFICATION
FOR Q601-Q608



IN-LINE TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

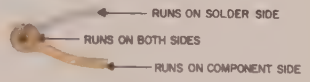
XFL601



XFL601

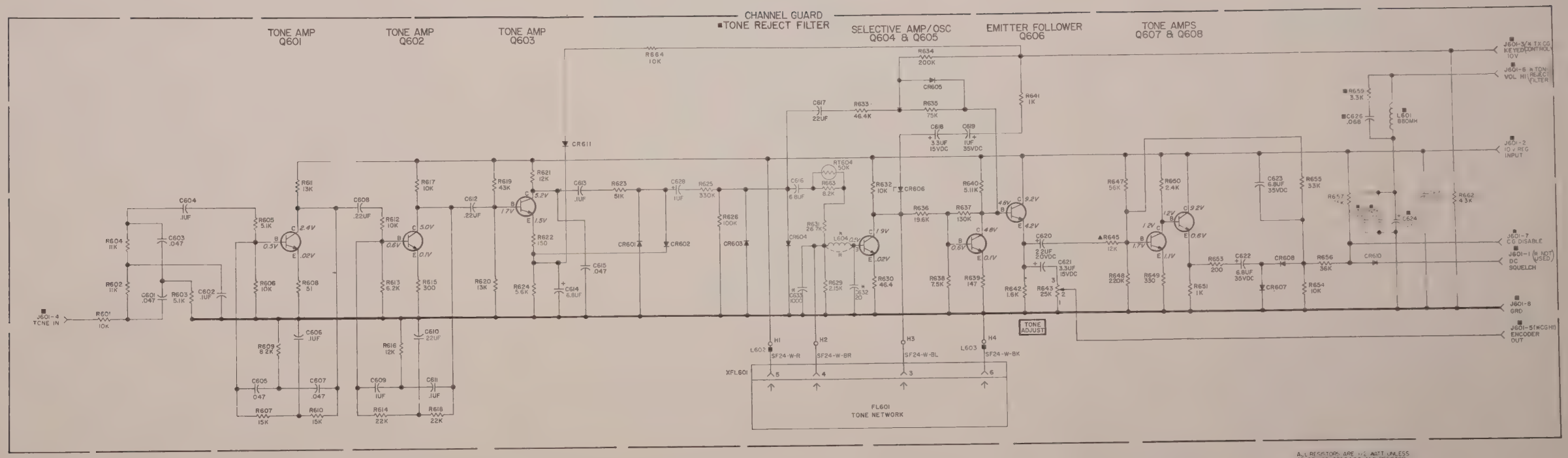
VIEW "A"

(19C317634, Rev. 4)
(19B216922, Sh. 1, Rev. 4)
(19B216922, Sh. 2, Rev. 3)



OUTLINE DIAGRAM

CHANNEL GUARD ENCODER/DECODER
MODELS 4EK14B10 AND 4EK14B11



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REV. S.ON LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EK14B10	C
4EK14B11	B

▲VALUE OF R645 IS DETERMINED BY TEST (SEE TEST SPECS)
*REPLACE L604 WITH DA WIRE FOR 4EK14B10. L604, C632, & C633 USED IN 4EK14B11 ONLY.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR PIN TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH NO TONE INPUT AND THE ENCODER NOT KEYED.

■ COMPONENTS THAT ARE COMMON TO CHANNEL GUARD & TONE REJECT FILTER.

* ALTERNATE FUNCTION WHEN USED WITH THE EXECUTIVE II RADIO

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS, OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19R621326, Rev. 5)

SCHEMATIC DIAGRAM

CHANNEL GUARD ENCODER/DECODER
MODELS 4EK14B10 AND 4EK14B11

PARTS LIST

LBI-4142C

CHANNEL GUARD ENCODER DECODER
4EK14B10 (19C317355G1)
4EK14B11 (19C317355G3)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C601	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C602	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C603	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C604	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C605	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C606	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C607	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C608	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C609	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C610	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C611	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C612	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C613	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C614	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C615	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C616	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C617	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C618	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C619	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C620	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C621	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C622 and C623	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C624	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C626	19A116080P206	Polyester: 0.068 µf ±5%, 50 VDCW.
C628	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C629 and C630	19A116080P110	Polyester: 0.33 µf ±10%, 50 VDCW.
C631	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C632*	5496216P46	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM. Added by REV A in Model 4EK14B11 only).
C633*	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV A in Model 4EK14B11 only).
		- - - - - - - DIODES AND RECTIFIERS - - - - -
CR601 and CR602	19A115250P1	Silicon.
CR603 and CR604	5494922P1	Silicon, sim to 1N456.
CR605	19A115250P1	Silicon.
CR606	4036887P3	Silicon, Zener.
CR607 and CR608	19A115250P1	Silicon.
CR610	19A115250P1	Silicon.
CR611*	19A115250P1	Silicon. Added to 4EK14B10 by REV C; Added to 4EK14B11 by REV B.
		- - - - - - - TONE NETWORKS - - - - - - - -
FL601	19B205280	Tone Detector. (Check group numbers for desired frequency).
	G1	71.9 Hz
	G2	77.0 Hz
	G3	82.5 Hz
	G4	88.5 Hz
	G5	94.8 Hz
	G6	100.0 Hz
	G7	103.5 Hz
	G8	107.2 Hz
	G9	110.9 Hz
	G10	114.8 Hz
	G11	118.8 Hz
	G12	123.0 Hz
	G13	127.1 Hz
	G14	131.8 Hz
	G15	136.5 Hz
	G16	141.3 Hz
	G17	146.2 Hz
	G18	151.4 Hz
	G19	156.7 Hz
	G20	162.2 Hz
	G21	167.9 Hz
	G22	173.8 Hz
	G23	179.9 Hz
	G24	186.2 Hz
	G25	192.8 Hz
	G26	203.5 Hz
	G30	74.4 Hz
	G31	79.7 Hz
	G32	85.4 Hz
	G33	91.5 Hz
	G34	97.4 Hz
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J601	19B209303P1	Plug, phen: 9 pins.
		- - - - - - - - INDUCTORS - - - - - - - - -
L601	19A115690P1	Reactor: 880 mh ind, 120 amp ±15% DC res; sim to Artted AC5672.
L602* and L603*	19A115700P2	RF Choke: sim to SL207. Added by REV A in Model 4EK14B10 only.
L604*	19B209420P125	Choke, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4. Added by REV A in Model 4EK14B11 only).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q601	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q602 and Q603	19A115123P1	Silicon, NPN.
Q604 thru Q607	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q608	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R601	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R602	3R77P113J	Composition: 11K ohms ±5%, 1/2 w.
R603	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R604	3R77P113J	Composition: 11K ohms ±5%, 1/2 w.
R605	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R606	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R607	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R608	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R609	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w.
R610	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R611	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R612	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R613	3R77P622J	Composition: 6.2K ohms ±5%, 1/2 w.
R614	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
R615	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R616	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R617	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R618	3R77P223J	Composition: 22K ohms ±5%, 1/2 w.
R619	3R77P433J	Composition: 43K ohms ±5%, 1/2 w.
R620	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R621	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R622	3R77P151J	Composition: 150 ohms ±5%, 1/2 w.
R623	3R77P513J	Composition: 51K ohms ±5%, 1/2 w.
R624	3R77P562J	Composition: 5.6K ohms ±5%, 1/2 w.
R625	3R77P334J	Composition: 330K ohms ±5%, 1/2 w.
R626	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R629	19A116278P233	Metal film: 2.15K ohms ±2%, 1/2 w.
R630	19A116278P65	Metal film: 46.4 ohms ±2%, 1/2 w.
R631	19A116278P342	Metal film: 26.70K ohms ±2%, 1/2 w.
R632	19A116278P301	Metal film: 100K ohms ±2%, 1/2 w.
R633	19A116278P365	Metal film: 46.40K ohms ±2%, 1/2 w.
R634	3R77P204J	Composition: 200K ohms ±5%, 1/2 w.
R635	19A116278P385	Metal film: 75K ohms ±2%, 1/2 w.
R636	19A116278P329	Metal film 19.60K ohms ±2%, 1/2 w.
R637	19A116278P412	Metal film: 130K ohms ±2%, 1/2 w.
R638	19A116278P285	Metal film: 7.5K ohms ±2%, 1/2 w.
R639	19A116278P117	Metal film: 147 ohms ±2%, 1/2 w.
R640	19A116278P269	Metal film: 5.11K ohms ±2%, 1/2 w.
R641	3R77P102J	Composition: 1K ohms ±5%, 1/2 w.
R642	3R77P162J	Composition: 1.6K ohms ±5%, 1/2 w.
R643	19B209358P107	Variable, carbon film: approx 800 to 25K ohms ±10%, 0.25 w; sim to CTS Type X-201.
R645A	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w.
R645B	3R77P912J	Composition: 9.1K ohms ±5%, 1/2 w.
R645C	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R645D	3R77P113J	Composition: 11K ohms ±5%, 1/2 w.
R645E	3R77P123J	Composition: 12K ohms ±5%, 1/2 w.
R645F	3R77P133J	Composition: 13K ohms ±5%, 1/2 w.
R645G	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R645H	3R77P752J	Composition: 7.5K ohms ±5%, 1/2 w.
R647	3R77P563J	Composition: 56K ohms ±5%, 1/2 w.
R648	3R77P224J	Composition: 220K ohms ±5%, 1/2 w.
R649	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R650	3R77P242J	Composition: 2.4K ohms ±5%, 1/2 w.
R651	3R77P102J	Composition: 1K ohms ±5%, 1/2 w.
R653	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R654	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R655	3R77P333J	Composition: 33K ohms ±5%, 1/2 w.
R656	3R77P363J	Composition: 36K ohms ±5%, 1/2 w.
R657	3R77P753J	Composition: 75K ohms ±5%, 1/2 w.
R659	3R77P332J	Composition: 3.3K ohms ±5%, 1/2 w.
R662	3R77P432J	Composition: 4.3K ohms ±5%, 1/2 w.
R663	3R77P822J	Composition: 8.2K ohms ±5%, 1/2 w.
R664*	3R77P103J	Composition: 10K ohms ±5%, 1/2 w. Added to 4EK14B10 by REV C. Added to 4EK14B11 by REV B.
		- - - - - - - THERMISTORS - - - - - - -
RT604	5490828P22	Thermistor: 50K ohms ±10%, color code yellow; sim to Carborundum type 703H-24.
		- - - - SOCKETS - - - -
XFL601	19B209341P1	Socket, tube: 7 pins; sim to Elco 04-720-XX.
		- - - - - - - MISCELLANEOUS - - - - - - -
	19A122138P1	Knob. (Used with XFL601).
	N107P408C13	Wood, screw. (Used with XFL601 in Tubed and Royal Executive only).
	N80P9005C13	Screw, machine. (Mounts printed circuit board).
	N404P11C13	Lockwasher, internal tooth: No. 4. (Mounts printed circuit board in Tubed and Royal Executive only).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Mounts 19B205387P1 support in Tubed and Royal Executive only).
	19B205387P1	Support. (Mounts FL601 in Tubed and Royal Executive only).
	4032591P28	Pressure sensitive pad. (Used with 19B205387P1 support in Tubed and Royal Executive only).
	19D416585P5	Support. (Used with XFL601 in Custom Executive).
	19B201074P205	Tap screw, Phillips POZIDRIV®: No. 4-40-5/16. (Secures XFL601 in Custom Executive).
	19B201074P204	Tap, screw, Phillips POZIDRIV®: No. 4-40-1/4. (Secures printed wiring board in Custom Executive).
	19A122213G1	Cover Kit. Includes:
	19B209209P305	Screw, tap: Phillips POZIDRIV®: No. 6-32 x 5/16. (Mounts cover thru the side rail).
	19B201074P305	Screw, tap: Phillips POZIDRIV®: No. 6-32 x 5/16. (Mounts cover to Tone Network).
W601		CABLE ASSEMBLY 19B226872G2
		- - - - PLUGS - - - -
P601	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P907		Connector. Includes:
	19A116659P81	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (Quantity 7).
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106. (Quantity 1).
	19A134048P1	Wood screw, phillips head: No. 4, 1/2 inch long.
	19A122138P1	Knob.
W603	19B205345G2	Channel Guard Cable, Tubed Executive combinations.
W604	19B216090G2	Channel Guard Cable, Royal Executive combinations.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

REV. A - Model 4EK14B10 only

To eliminate RF interference. Added L602 and L603.

REV. A - Model 4EK14B11 only

REV. B - Model 4EK14B10 only

To eliminate RF interference in Custom Executive applications
Added C362, C363 and L604.

REV. C - Model 4EK14B10 only

REV. B - Model 4EK14B11 only

To stabilize encoder frequency.
Added CR611 and R664.

PARTS LIST

LBI-4171B

TONE REJECT FILTER
19C317355G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C624	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C626	19A116080P206	Polyester: 0.068 µf ±5%, 50 VDCW.
C629 and C630	19A116080P110	Polyester: 0.33 µf ±10%, 50 VDCW.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J601	19B209303P1	Plug, phen: 9 pins.
		- - - - - - - - - INDUCTORS - - - - - - - -
L601	19A115690P1	Coil, RF: 880 mh ±5%, sim to Artted AC5672.
		- - - - - - - - - RESISTORS - - - - - - - - -
R659	3R77P332J	Composition: 3.3K ohms ±5%, 1/2 w.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	N80P9005C13	Screw, machine. (Mounts printed circuit board).
	N404P11C13	Lockwasher. (Mounts printed circuit board).
	19A122213G1	Cover Kit. Includes:
	19B209209P305	Screw, tap: Phillips Pozidriv®: No. 6-32 x 5/16. (Mounts cover thru the side rail).
	19B201074P305	Screw, tap: Phillips POZIDRIV®: No. 6-32 x 5/16. (Mounts cover to Tone Network).
W601		CABLE ASSEMBLY 19B226872G2
		- - - - PLUGS - - - -
P601	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P907		Connector. Includes:
	19A116659P81	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (Quantity 7).
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106. (Quantity 1).
	19A134048P1	Wood screw, phillips head: No. 4, 1/2 inch long.
	19A122138P1	Knob.
W603	19B205345G2	Channel Guard Cable, Tubed Executive combinations.
W604	19B216090G2	Channel Guard Cable, Royal Executive combinations.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

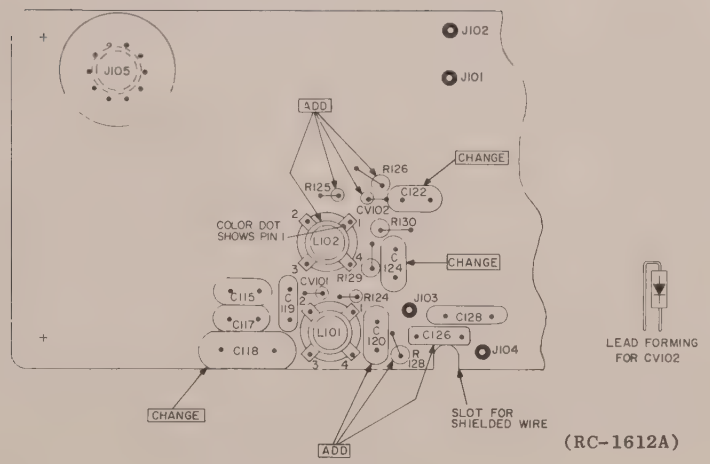


Figure 1 - Component Location (Exciter Board)

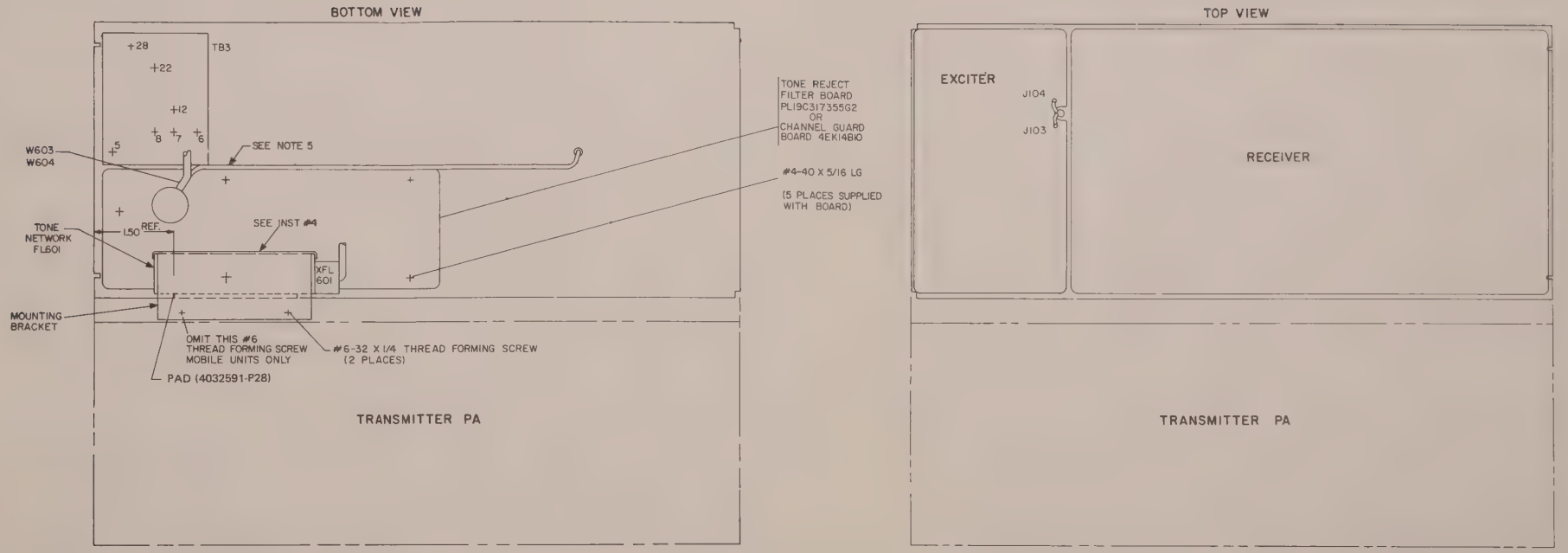
PROCEDURE

1. Remove the four screws holding the transmitter exciter. Then remove connections from J101, J102 and J105 and remove the exciter board.

2. Modify the exciter board using appropriate kit (19A122624G1 thru G3) as instructed in Table 1. Component location is shown in Figure 1.

EXCITER MODEL NUMBER	MODIFICATION KIT NUMBER	ADD	REPLACE	CHANGE MODEL NUMBER FROM	CHANGE MODEL NUMBER TO
4EG21A10 4EG21A12	19A122624-G1 Service Parts Kit #0035	C120 (470 pf, 100 VDCW) C126 (0.01 µf, 40 VDCW) CV102 L102A R125 A (0.15 megohm. 1/4w) R126 (10,000 ohms, 1/2 w) R128 (15,000 ohms, 1/2 w)	C125 with C118 A (.0015 µf, 100 VDCW); C121 with C122 A (220 pf, 500 VDCW); and C123 with C124 (150 pf, 100 VDCW)	4EG21A10 4EG21A12	4EG21A11 3EG21A13
4EG21B10 4EG21B12	19A122624-G2 Service Parts Kit #0036	C120 (470 pf, 100 VDCW) C126 (0.01 µf, 40 VDCW) CV102 L102B R125 B (0.12 megohm, 1/4w) R126 (10,000 ohms, 1/2 w) R128 (15,000 ohms, 1/2 w)	C125 with C118 A (.0015 µf, 100 VDCW); C121 with C122 A (220 pf, 500 VDCW); and C123 with C124 (150 pf, 100 VDCW)	4EG21B10 4EG21B12	4EG21B11 4EG21B13
4EG21C10 4EG21C12	19A122624-G3 Service Parts Kit #0037	C120 (470 pf, 100 VDCW) C126 (0.01 µf, 40 VDCW) CV102 L102 C R125 C (0.1 megohm, 1/4w) R126 (10,000 ohms, 1/2 w) R128 (15,000 ohms, 1/2 w)	C125 with C118 A (.001 µf, 100 VDCW); C121 with C122 B (180 pf, 500 VDCW); and C123 with C124 (150 pf, 100 VDCW)	4EG21C10 4EG21C12	4EG21C11 4EG21C13

Table 1 - Exciter Board Modification



CONNECTIONS CHART FOR MASTR PROGRESS LINE EXECUTIVE SERIES		
FROM	WIRE COLOR	TO
W603	G	STATION TB8-1 MOBILE TB3-17
W603	BR	TB3-23
W603	W-O-R	TB3-6
W603 CENTER CONDUCTOR	W-BL	TB3-7
W603-SHIELD OF ABOVE		TB3-8
W603	BK	TB3-22
W603 CENTER CONDUCTOR	W-BK	EXCITER-J103
W603-SHIELD OF ABOVE		EXCITER-J104
W603	V	TB3-5
W603	W-R-G	TB3-12

PROCEDURE

1. Mount the Channel Guard board or the Tone Reject Filter board as shown using the five #4-40 screws supplied with the board.
2. Install the cable W603 (W604 for Royal) from the Channel Guard board or the Tone Reject Filter board to TB3 and the Exciter board. Make the connections as shown in the appropriate chart. Remove the Exciter board to feed the shielded cable through the hole in the chassis and the slot in the Exciter board.
3. Insert the tone network into the mounting bracket. Plug the socket XFL601 from the Channel Guard board into the Tone Network. Install the pressure sensitive pad 4032591-P28 on the chassis as shown, approximately 0.3" down from mounting support of Tone Network.
4. Rotate the Tone Network until the marking appears on this surface (see Diagram). Mount the assembly as shown using the two #6-32 thread-forming screws supplied.
5. When the Decode only option (8014) or Tone Reject Filter (19C317355-G2) are used, cut-off and discard the shielded cable connecting the Channel Guard board and the Exciter board.
6. Install the accessory cover with the hardware supplied.

(19D413570, Rev. 1)

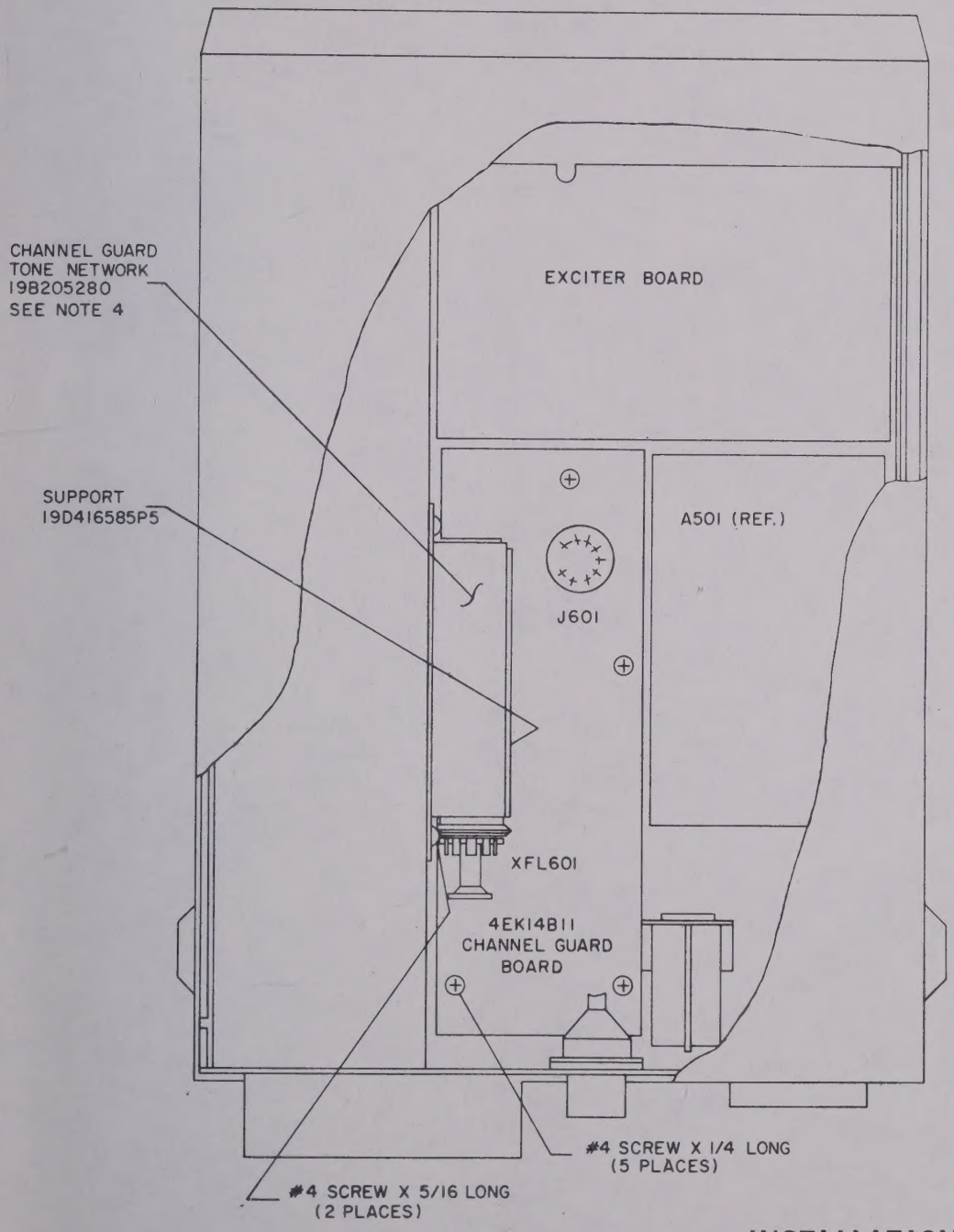
CONNECTION CHART FOR MASTR PROGRESS LINE ROYAL EXECUTIVE		
FROM	WIRE COLOR	TO
W604	W-G-O	TB3-27
W604	BR	TB3-41
W604	W-O-R	TB3-26
W604 CENTER CONDUCTOR	W-BL	TB3-37
SHIELD OF ABOVE		TB3-44
W604 CENTER CONDUCTOR	W-BK	EXCITER-J103
SHIELD OF ABOVE		EXCITER-J104
W604	R	TB3-5
W604	G	TB3-29

INSTALLATION DIAGRAM

CHANNEL GUARD MODEL 4EK14B10
MASTR EXECUTIVE, EXECUTIVE AND
ROYAL EXECUTIVE MOBILE AND
STATION COMBINATIONS

NOTES:

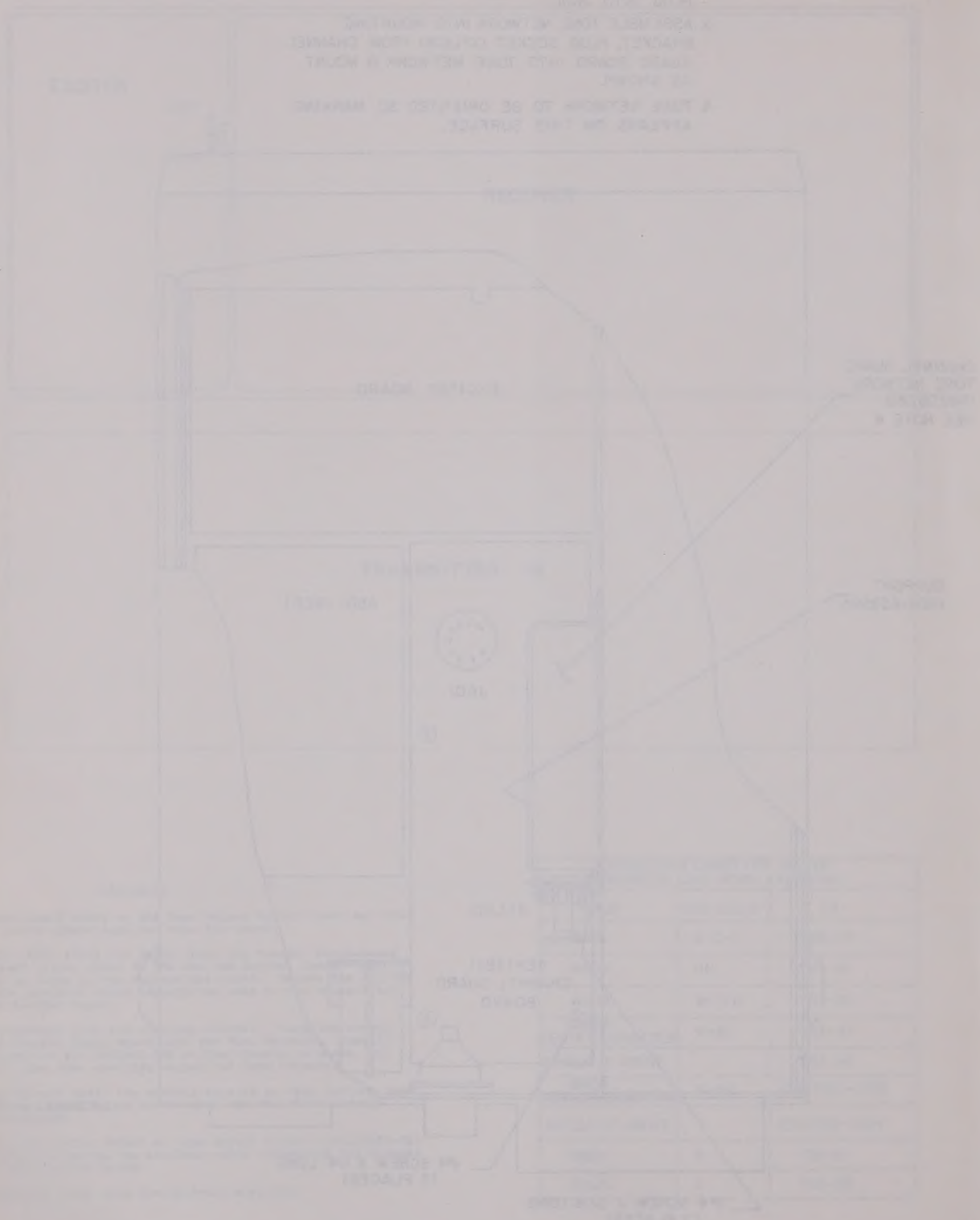
1. MOUNT CHANNEL GUARD BOARD ON CHASSIS AS SHOWN.
2. CUT SPOT TIE HOLDING P601 TO HARNESS & PLUG INTO J601.
3. ASSEMBLE TONE NETWORK INTO MOUNTING BRACKET, PLUG SOCKET (XFL601) FROM CHANNEL GUARD BOARD INTO TONE NETWORK & MOUNT AS SHOWN.
4. TONE NETWORK TO BE ORIENTED SO MARKING APPEARS ON THIS SURFACE.



(19C320202, Rev. 1)

INSTALLATION DIAGRAM

CHANNEL GUARD MODEL 4EK14B11
CUSTOM EXECUTIVE MOBILE COMBINATIONS



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